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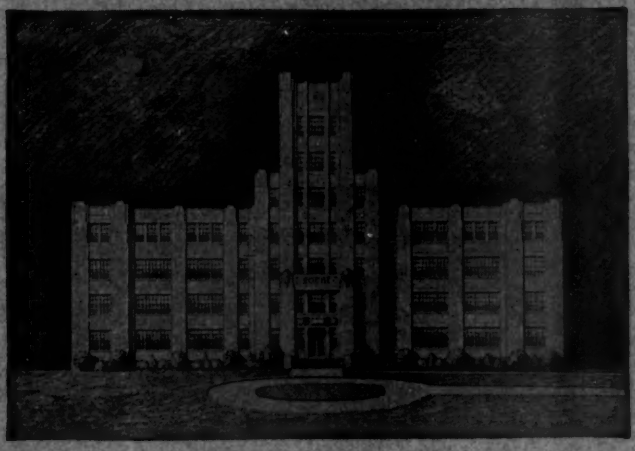

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THE AMERICAN
JOURNAL OF PHARMACY

VOL. 101 JULY, 1929 NO. 7

EDITORIAL

"RIGHT ABOUT FACE"

AN "ANTISEPTIC" editorial, appearing in the December, 1926, issue of this JOURNAL, drew quite promptly, what was intended to be a most "germicidal" comment, from an officious bureaucrat in the National Capital. Since that day, much water and many fish, dead and alive, have passed under the bridge of Washington bureaucracy. And it has come to pass that the gentleman who wrote that letter is no longer adjusting dictionaries and dissembling definitions. In other words one more nuisance has abated. But a new order is *temporarily* in office and new personal views are about to be inflicted upon us—weary as we are—of silly, get-nowhere regulations that all too frequently pour out of these governmental bureaus.

Yet we salute the new order and are happy to note in it a tendency to saner decisions. Listen:

> "While we are not surprised that Dr. J. J. Durrett thinks differently on the question of antiseptics and germicides than did his predecessor in the office of drug control official, we are indeed surprised in the manner in which he differs. The entire drug trade was quite recently educated to the fact that the public conception of antiseptic was a product that killed bacteria—in fact a germicide. Merely because the dictionary differed on the definitions of these two types of products—giving antiseptic as an inhibitor of germ growth and a germicide as a germ destroyer—did not matter: the public thought them both the same. Therefore, ruled the department, a product label 'antiseptic' must be in fact a germicide.
>
> "But, strange to say, Dr. Durrett has no such ideas. His statement made before the members of the American Pharmaceutical Manufacturers' Association contended that the depart-

ment 'does not think the dictionary is wrong.' Going on to explain just what he meant, the Doctor stated that when an antiseptic was of such a type or was used under such conditions as to be applied over a long period, a product that merely inhibits the growth of germs may be labeled 'antiseptic.' In the matter of oral products, however, the user is in a hurry, he only washes his mouth for a minute or so. Therefore, states the Doctor, all products used in oral antisepsis must be germicides before they can be labeled 'antiseptic.'

"We very well know that the industry accepted in good grace the former ruling of the department. They could see no objection to labeling products in keeping with the public conception. They immediately accepted the department's ruling in the spirit in which it was made. But now after changing all their labels in one direction, certain of them may be changed back to where they were. According to the present enforcement official there never was any reason why certain of these labels should have been changed.

"It is just this sort of thing that makes a different type of of regulation drug products imperative. To think that two men can not only differ on such a simple case, but can go so far as to enforce their own personal views and thus cause unnecessary embarrassment and trouble to reputable manufacturers, is too much."

That is how the Editor of "Drug Markets" feels about it.

And this is how the Editor of the AMERICAN JOURNAL OF PHARMACY felt about the matter three years ago—and now.

We are informed that the Bureau of Chemistry at Washington has been, for some time, uproariously upheaved over the proper interpretation of the word "antiseptic."

Generally speaking, however, it is alleged that the Bureau has finally come to the conclusion, although no regulations have been issued, that an *antiseptic* substance must be capable, in its applied dilution, of destroying not only the arithmetical genius of the germ, that is, its ability to multiply by division, but it must also destroy the very germ itself.

In short, an antiseptic must be a germicide. If this finding of the Bureau has been properly interpreted to us—and we believe it has—it moves us to wonder how, in the face of the current acceptance of this word's meaning, the Bureau could possibly hold such an arbitrary notion.

Dictionaries, medical and otherwise; pharmacopœias and formularies, dispensatories and textbooks on bacteriology and hygiene, etc.;

catalogues and price lists of pharmaceuticals and medicinals—all may be summoned in vast array to contradict the Bureau's attitude.

Literally, of course, one may excursion back to the root meanings of the word and find there a suggestion of fatalism—of utter germ destruction—of ferocity of action, but in the changing fashions of the vocabulary we believe that it has taken to itself a milder, gentler meaning.

Not for a moment does the word bring to us a sense of brutal killing—a relentless destruction of little one-celled beings—but rather a gentler, more persuasive sense of microgermic contraception.

Listen to what our little vest pocket dictionary states about the antiseptic—"anything that restrains the growth of germs"—nothing said there about phenol coefficients—or about the bacillus paratyphosus in active youth. No intimation there of a heartless, brutal killing.

And this is what the semi-portable Webster and the Medical Dorland record:

> "Preventing decay or putrefaction" (Webster);
> "Some of the chief antiseptics are (*among others*), boric acid, common salt, charcoal, sugar and vinegar" (Dorland).

But the Bureau claims that an antiseptic is a germicide. Imagine the death-throes of the flagellating typhoid germ in a dish of sugar water! Who ever heard of an anthrax germ putting on its resistant asbestos overcoat in a bath of salt and water?

Let the Pharmacopœia and the National Formulary change their terminology,* for according to this harsher interpretation of *antiseptic*—official preparations so labeled must conform to the germicidal status. They must not just stay the growth of germs. They must actually exterminate them.

No longer will *Liquor Antisepticus N. F.* suffice for a title, for when that preparation, with all its alcohol, is diluted to halitotic strength, a little staphylococcus could use it for a swimming pool, and thoroughly enjoy its aromatic, eucalyptic bath.

Let the host of packaged medicines, mouth-washes, gargles and the like, self-ordained as antiseptics, pass away from the picture, for they are also under false colors.

*They did!

Perhaps the new interpretation was especially designed for that particular class. One never knows.

A test similar to the Rideal-Walker test for germicidal value, is proposed by the Bureau, for the examination of the so-called antiseptic liquids. It is even more stringent than our present phenol-coefficient tests—and, as applied, we question that any of the commonly called antiseptics will measure up to its specifications.

Investigators have recently questioned the actual skin sterilizing efficiency of even such potent germicides as iodine and salts of mercury.

How in the world, then, it is possible to place bland, isotonic cleansers of mucous membranes on a basis of efficiency still superior to that of the corrosive germicides is quite beyond our understanding.

So we repeat our impression that a germicide is an antiseptic—but that an antiseptic is not necessarily a germicide.

Purged by purists—filigreed by foreigners—tormented by typesetters—slaughtered by slangsters—the staid old English vocabulary has suffered long and dumbly.

And now to add to its miseries along comes scientific Washington, with officious arbitrariness, defining well-established words to suit its own sweet purpose.

IVOR GRIFFITH.

THE NECESSITY FOR AN INTERNATIONAL LANGUAGE

IN THE CENTURIES immediately following the revival of learning, communication between scientists and philosophers of the principal European nations was available through Latin which was a dominant part of all college training. Many of the original communications to science and philosophy are in that tongue. At the present time it has little vogue outside of classical and religious circles. Diplomatic documents which now constitute much of the literature of world affairs are composed in French, and translated into the languages of the nations concerned.

The loss of Latin has provoked a desire for a substitute, especially during the last quarter-century, on account of the conventions on scientific and sociologic topics, at which representatives from many

nations are present. In earlier years, it was generally sufficient to present the papers and discussions in two languages, that of the nation in which the meeting was held and French. The greatly increased activity of some nations, Italy, Russia, Japan, the Scandinavian and Czech groups has necessitated admitting several other tongues. German of course was admitted to the official group many years ago.

In a recent number of *Science* Dr. Austin M. Patterson, who has a prominent place in American chemistry, and for some years especially in the publications of the American Chemical Society, refers to the difficulty from the "confusion of tongues" in connection with efforts now making to secure an international organization of chemists. He contrasts the difficulty of discussion at a meeting at which English, French, German and Italian were used, many of those present being, indeed, not native to any of these tongues, with the frank and free discussions that took place at a convention of Esperantists. A great many artificial languages have been suggested, but none seems to have secured such extensive adoption as Esperanto. It has several excellent features, but two awkward ones, accented letters and duplicate objective cases. The latter have about the same grammatical use as the accusative and ablative in Latin and the accusative and dative in German. There is no need of this. Except as to pronouns, several great languages, English, French, Spanish and Italian are used with entire satisfaction without any such distinction. Some of the defects of Esperanto have been remedied in an amended form called "Ido," but Esperantists have denounced these amendments fiercely.

To be entirely satisfactory, an artificial language will have to be based on several radical departures from the standard tongues. All consonants that have markedly different pronunciations must be eliminated. This will cancel "c," "w," "h," "j." "Q" might be replaced by "ku" and "x" by "ks." The five vowels should have standard pronunciations, the English flat "a" and all accents, including umlauts should be excluded. The verb should receive careful study. All the phases of which it is capable of expressing should be clearly indicated by moods and tenses. The usual plan of simply taking the forms from some standard language does not suffice.

HENRY LEFFMANN.

ORIGINAL ARTICLES

OBSERVATIONS ON THE KEEPING PROPERTIES OF DIGITALIS AND SOME OF ITS PREPARATIONS*

By Harvey B. Haag and Robert A. Hatcher

Department of Pharmacology, Cornell University Medical College, New York City

THIS PAPER records the results of observations begun in this laboratory many years ago and is the second published in this JOURNAL under the same title, the first by Hatcher and Eggleston[2] having been published in May, 1913. They said, "The opinion is prevalent among both physicians and pharmacists that digitalis and its preparations undergo deterioration with considerable rapidity." We might with equal reason repeat that statement to-day. We have made no systematic study of the causes of deterioration of preparations of digitalis such as alcoholic concentration, temperature, oxidation, alkalinity and acidity, but all those factors are considered in one or more of our experiments and we believe that our results throw light on the problem. We employed the cat method[3] for the determination of activity as Hatcher and Eggleston did. For convenience, the activity of the tincture is expressed in terms of milligrams of the leaf represented in the fatal dose per kilogram of cat, and this is termed a cat unit, hence the greater the figure the weaker the tincture. A tincture which has a cat unit of 150 milligrams is only one-half as active as one having a cat unit of 75 milligrams. Fractions of a milligram are omitted. We have accepted a cat unit of 100 milligrams as the average for digitalis of good quality. Those tinctures, the origin of which is not stated, were made in this laboratory.

Six specimens of digitalis powder were examined in this laboratory and after intervals varying from two and a half to five years, four were re-examined by Gold and DeGraff,[4] and in no case had deterioration occurred. They have used the other two in the clinic and have been unable to observe any evidence of deterioration after intervals of two and four years, respectively.

Hatcher and Eggleston examined a specimen of digitalis leaf obtained from E. R. Squibb and Sons in 1913, at which time it had

*Those results of this investigation which are of interest to physicians chiefly have been published in the *Journal of the American Medical Association*[1] without details of the experiments. The present paper deals with those factors which are of special interest to pharmacists.

been kept in glass at least 25 years. The leaves were powdered in 1913 and placed in a corked wide-mouthed bottle, since which time the powder has been kept without special precaution. This powder, now 41 years old, is fully as active as the average digitalis of good quality now obtainable. We made a tincture by maceration with 75 per cent. alcohol because only a few grams of the powder remained. Closely concordant tests on two cats showed that an average of 89 milligrams of this powder equals one cat unit, this being the same activity which Hatcher and Eggleston had found.

A specimen of digitalis of the crop of 1905 ground by Gilpin, Langdon and Company was received in this laboratory in 1906, since which time the powder has been kept in the original carton. Two tests in close agreement show that 145 milligrams of this specimen equals one cat unit, this being below the average of good digitalis now available, but if any deterioration has occurred it has been slow, and we have no reason to think that it has deteriorated.

Many specimens of powdered digitalis known to be more than a year old, and some of them much older, have been examined in this laboratory during the past twenty years. In no case was there reason to think the drug had deteriorated and probably the weakest specimen of digitalis ever examined in the laboratory was one which was supposedly fresh and with which a certificate of potency had been furnished.

The results of our examinations of digitalis leaf are in harmony with those of all whom we have cited [1] with the exception of Focke. We are not concerned at this time with the maximum activity of the leaf at the moment that it is gathered, but with that after it has been dried, and as it is used by the retail pharmacist or the pharmaceutical manufacturer, and there is no reason to believe that digitalis deteriorates during many years if it is kept with reasonable care.

A specimen of fluidextract of digitalis made by E. R. Squibb forty-six years ago was received in this laboratory in 1913, at which time it was tested and found less than ten times as active as the average tincture of digitalis. One of us examined it six years later and found no change in activity and we have found no change after an interval of sixteen years, but we cannot be certain that it had not become concentrated by evaporation, as the bottle contained only a few cubic centimeters of the fluidextract.

A fluidextract of digitalis, containing 38 per cent. alcohol, made by the H. K. Mulford Company in 1912, was examined in this labora-

tory in April, 1913, at which time 79 mg. equalled one cat unit. Six years later it had lost about 17 per cent. of its activity and after sixteen years, about 32 per cent.

A specimen of the tincture made by E. R. Squibb and Sons in 1904 and received in 1913 was kept unopened until it was examined in 1929, at which time the cat unit was 162 mg., hence the activity was about 60 per cent. of that of the average fresh tincture of good quality.

Two tinctures were made from the same specimen of leaf by E. R. Squibb and Sons, in April, 1911. The powder used in making the first of these was treated with magnesium carbonate to remove calcium salts and to neutralize acidity. After eighteen years it was about half as active as the average tincture of digitalis and about 40 per cent. less active than the other specimen of the same date. A fat-free specimen of tincture of digitalis from E. R. Squibb and Sons, made in 1913, was a little less than half as active as the average specimen, after an interval of sixteen years.

A tincture made in October, 1912, containing about 45 per cent. alcohol, and examined at that time, was re-examined after sixteen and one-half years. It had lost about 50 per cent. of its activity. A tincture was made in July, 1913, containing about 70 per cent. of alcohol, at which time 105 mg. equalled a cat unit. After nearly sixteen years, 144 mg. equalled one cat unit, showing a loss of about 27 per cent. Another specimen made with 50 per cent. alcohol in the same year from the leaf, then 25 years old, lost about 38 per cent. of its activity in 16 years.

A fat-free tincture containing 45 per cent. alcohol, made by Sharp and Dohme about October, 1924, was tested in April, 1929, at which time 153 mg. equalled one cat unit, its activity then being about 35 per cent. below that of the average tincture of good quality.

A specimen of Digitol Mulford, containing 70 per cent. alcohol, was received in September, 1918, and tested in March, 1929, at which time 148 mg. equalled one cat unit. It was about 28 per cent. less active than a specimen obtained in 1929 directly from the manufacturers and tested at once. A specimen of Digitol containing 70 per cent. alcohol, in a sealed glass tube of unknown age, but probably more than ten years old, was tested in March, 1929, at which time 182 mg. equalled one cat unit, being 42 per cent. less active than the fresh specimen just mentioned.

A specimen of tincture containing about 70 per cent. alcohol was made and tested in January, 1918, at which time 85 mg. equalled one

cat unit. When tested in March, 1929, 130 mg. equalled one cat unit, showing a loss of about 35 per cent. of its activity in eleven years. The activity of a specimen prepared in March, 1920, and containing 70 per cent. alcohol, was 76 mg. per cat unit. In July, 1920, it had lost nearly one-half of its activity, and when tested in March, 1929—nine years after the first test—145 mg. equalled one cat unit, showing that little change took place after the first six months following its preparation. A tincture containing 70 per cent. alcohol was prepared in August, 1922, at which time 80 mg. equalled one cat unit. When tested in March, 1929, 93 mg. equalled one cat unit, a loss of about 14 per cent. in nearly seven years. A specimen was prepared in September, 1924, at which time 85 mg. equalled one cat unit. When tested in April, 1929, the cat unit was 102 mg., showing a loss of about 17 per cent.

Two specimens of purified tincture prepared by one of us with 60 per cent. alcohol in 1921 and one in 1922, retained their activity unimpaired in 1929, and an ether-soluble fraction of digitalis principles in 60 per cent. alcohol also retained its activity unchanged during eight years. The purified tincture consists of the so-called gitalin fraction of digitalis obtained by shaking an infusion with chloroform, distilling the chloroform and dissolving the residue in 60 per cent. alcohol. One weakly alcoholic solution of the residue of the purified tincture became inert, another lost about half of its activity in nine years. The stability of the purified tincture is of interest, but of comparatively little practical importance because the official tincture is sufficiently stable for nearly all purposes.

Hatcher and Eggleston [5] showed that infusion of digitalis kept with ordinary care decomposes slowly. One of their specimens, to which fecal matter had been added, lost 40 per cent. of its activity in 18 days. Another specimen left uncorked lost 25 per cent. in 20 days, but there was no loss in activity in any of three other specimens. One was examined 19 days after sweepings had been added; the second, which had been opened frequently, was examined after 21 days; and the third, which had been kept corked during the summer, was examined after 79 days.

One of us prepared an infusion of digitalis in 1918, heated it to the boiling point, and with it completely filled small bottles into which corks were forced, after which the bottles were sealed with paraffin. The activity of the infusion was determined shortly after it was made, after an interval of a year, and after an interval of about two years and five months, at which time it was also used clinically by Dr. Cary

Eggleston. No deterioration could be detected by the laboratory tests and it produced the typical therapeutic effects of digitalis without toxic side actions. This infusion was tested in the laboratory after an interval of nearly eleven years, at which time the activity was about one-half the original, but sufficient doses produced the typical digitalis action.

Another specimen of infusion was prepared and bottled in the same way in February, 1921. This sterile infusion was protected from light and air but without other special care. When tested in November, 1928, it had lost about 65 per cent. of its activity. It was then stored during the winter in an overheated room almost directly over the furnace and when tested in April, 1929, it was about one-fourth as active as it was in 1921. It was administered to two patients through the courtesy of Dr. John Wyckoff, by Dr. Harry Gold, who reported that it induced the typical therapeutic effects without toxic side actions.

We also examined a number of proprietary preparations of digitalis which had been kept in ampules, but in general they showed no greater stability than the majority of the tinctures mentioned above.

At the request of one of us, Hynson, Wescott and Dunning prepared ampules of soft glass and others of hard glass containing solution of ouabain, in November, 1918. The solution in the ampules of soft glass lost about 90 per cent. of its activity in about eleven months. That contained in hard glass decomposed more slowly. There was little perceptible change within one year; there was a loss of about 60 per cent. of activity in five years, and during the next six years some of the ampules continued to deteriorate, while others showed practically no further change. Ouabain solution in soft glass ampules prepared in this laboratory in 1918 showed no deterioration in six weeks, and the same solution in glass-stoppered bottles showed no change in three months, but the solutions in soft glass ampules and bottles are now inert or nearly so. Ampules of amorphous strophanthin imported more than ten years ago were also inert or nearly so.

Ouabain, dissolved in strong alcohol and kept in a glass-stoppered flint bottle in the laboratory during twenty-one years, showed a loss in activity of only 20 per cent. The foregoing shows that soft glass should not be used for ampules containing aqueous solutions of ouabain or amorphous strophanthin, and it points strongly to the alkalinity of the glass as a disturbing agent.

The fact that the tincture made from the leaf in which the acidity had been neutralized decomposed more rapidly than that made from the untreated leaf, shows that acidity is not the chief factor in decomposition. It is possible, however, that the greater decomposition in this specimen was due to alkalinity.

It will be observed that several of the tinctures containing a high percentage of alcohol decomposed as rapidly as the fluidextract containing only 38 per cent. of alcohol, and that one of our specimens containing 70 per cent. of alcohol deteriorated rapidly during the first six months, while another specimen made with the same menstruum lost only about 14 per cent. in seven years. Hence, a low percentage of alcohol is not the sole cause of decomposition, and the fact that the tincture containing a high percentage of alcohol and kept in sealed glass also decomposed shows that the air contained in the bottle is not the chief cause of decomposition.

The facts point strongly to the view that decomposition of the active principles is induced by some substance which is present in the leaf in varying proportions, some specimens containing a larger percentage than others and undergoing correspondingly more rapid decomposition. This disturbing substance is itself probably decomposed in the process because very old alcoholic preparations are not inert. This view is supported by the fact that four purified tinctures (including that of the ethereal extract) made with strong alcohol did not decompose. The value of a high concentration of alcohol is shown, however, by the fact that the purified principles decomposed in solutions of low alcoholic content.

Decomposition is not due solely to a ferment because it occurs in infusions that have been sterilized by heat and from which the air has been excluded.

It is significant that ten of the tinctures containing 38 per cent. or more of alcohol and varying in age from four and one-half years to twenty-five years, were of approximately the same activity, the weakest, twenty-five years old, being only 12 per cent. below the average, and the most active only 11 per cent. above the average. Furthermore the weakest of all the tinctures examined by us, which was sixteen years old and contained 44 per cent. of alcohol, was of approximately the same activity as the fresh tincture prepared from the poor commercial specimen previously mentioned with which a certificate of potency had been furnished. This affords additional evidence that only certain of the active constituents decompose in an alcoholic

menstruum, and that different specimens of digitalis contain a nearly uniform percentage of that active constituent which is not decomposed in strong alcohol.

This requires further investigation, and it is especially desirable to know whether the stable fraction is that which is most readily absorbable from the gastro-intestinal tract, for it is well known that different digitalis principles are absorbed at widely different rates.

Summary

We have been unable to find any satisfactory evidence that dried digitalis leaf deteriorates when kept with ordinary care.

Fluidextracts and tinctures of digitalis decompose at somewhat variable rates. The deterioration is seldom rapid and the fluidextract or the official tincture may be used with confidence.

The infusion of digitalis decomposes somewhat more rapidly than the tincture, but it decomposes so slowly that it may be used with confidence during a period of several weeks.

It is probable that digitalis contains some substance which causes the decomposition of some active principles and that it is itself decomposed in the process.

It is probable that digitalis contains an active principle which resists decomposition. Hence, very old tinctures have nearly 70 per cent. of the activity of the average fresh tincture of good quality.

No foreign toxic substance develops during the deterioration of the tincture or the infusion and old tinctures and infusions produce typical therapeutic effects when the dosage is increased to correspond with the degree of deterioration.

Ampules should be made of glass containing a minimum of soluble alkali.

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THE CRESYL ESTERS OF PHENYLACETIC ACID*

By L. Chas. Raiford and J. G. Hildebrand, Jr.

ALTHOUGH the p-cresyl ester of phenylacetic acid is mentioned by Parry [1] and by Poucher [2] as an important synthetic used by the perfumer, and is listed by the United States Tariff Commission [3] as a well-known product, little has been published concerning its properties. Poucher states that it melts at 86°,[4] and makes a brief reference to its odor,[5] but a search of the literature failed to disclose any record of its preparation. The following report gives a method of preparation and analyses for the isomeric cresyl esters of phenylacetic acid.

Attempts to prepare these esters by heating a mixture of the cresol the acid and a dehydrating agent, such as zinc chloride or syrupy phosphoric acid, were unsuccessful. Good yields of the desired products were obtained by the action of phenylacetyl chloride on the cresols.

Experimental Part

Phenylacetyl chloride. This was prepared by the interaction of thionyl chloride [6] and phenylacetic acid, using a modification of the general method of Meyer.[7] The reaction mixture was placed in flask A, which is provided with a thermometer to indicate reaction temperature. The vertical arm of the connecting tube is tall enough to prevent thionyl chloride from passing over during the reaction, and carries at the top a thermometer for use in distillation. One part

*Contribution from the Laboratory of Organic Chemistry of the State University of Iowa.

[1] Parry, E. J.: *Cyclopedia of Perfumery,* Vol. I, p. 169. Philadelphia, Blakiston (1926).

[2] Poucher, W. A.: *Perfumes, Cosmetics and Soaps,* Vol. I, p. 97. New York, Van Nostrand (1926).

[3] Tariff Information, Series No. 35. Census of Dyes and Other Synthetic Organic Chemicals in 1926, p. 72. Washington, Government Printing Office (1927).

[4] The product synthesized in the present work (see experimental part) melted at 74-75°, and melted without depression when mixed with the Florasynth Laboratory product, m. p. 74-75°.

[5] He refers to the odor and use of the m-cresyl ester, also, but gives no other data concerning it.

[6] Raiford and Lankelma: *J. Am. Chem. Soc.,* 47, 1119 (1925); McMaster and Ahmann, *Ibid.,* 50, 145 (1928).

[7] Meyer: *Sitzungsber. Kaiserl. Akad. Wissensch.,* 110, Abt. II, 318 (1901).

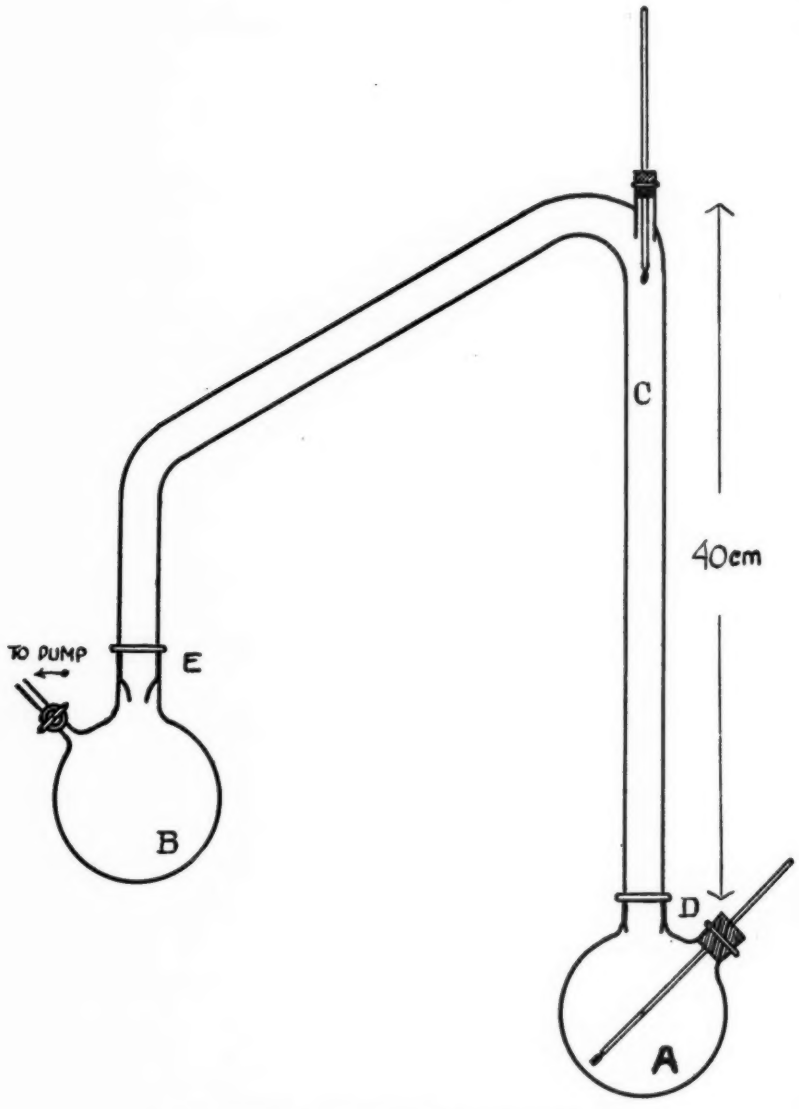


Fig. 1—Apparatus for preparation of phenylacetyl chloride.

by weight of phenylacetic acid and 1.5 to 2 parts [8] of thionyl chloride were placed in flask A, the flask attached to the connecting tube, and the mixture heated at 90° to 100° [9] for three hours. The excess of thionyl chloride was then distilled off under atmospheric pressure, and the residue fractionated under reduced pressure.[10] Phenylacetyl chloride passed over at 100–101° under 16 mm.,[11] as a colorless, heavy liquid. Yield, 92 per cent.

p-Cresyl phenylacetate. A mixture of 11 g. of freshly distilled p-cresol and 16 g. of phenylacetyl chloride was heated at about 90° in a small, wide-mouth flask until the evolution of hydrogen chloride ceased, the mixture cooled, and poured with rapid stirring into 200 cc. of previously chilled [12] 6N sodium hydroxide solution. After some time the solid was filtered off and washed. Yield, 83 per cent. Three crystallizations from alcohol gave colorless masses of small blocks; m.p. 74–75°. The product was further identified by hydrolysis, isolation and recognition of the corresponding phenol and acid.

Anal. Subs., 0.1953 : CO_2, 0.5693; H_2O, 0.1102
Calcd. for $C_{15}H_{14}O_2$: C, 79.64; H, 6.19. Found,
C, 79.50; H, 6.31.

m-Cresyl phenylacetate. This was prepared in 72 per cent. yield by the method described, and was obtained in colorless, thick irregular plates by repeated crystallization as follows: The hot alcoholic solution in a small filter flask was diluted with enough water so that at about 40° it became turbid. The mouth of the flask was then closed with a one-hole stopper bearing a narrow glass tube, the lower end of which was 2.5 to 3 cm. above the surface of the liquid, the temperature raised to about 45° and held there, while slow evaporation was brought about by gentle suction through the side neck of the flask. Colorless, irregular plates were obtained; m.p., 51–52°. It was characterized as indicated above.

Anal. Subs., 0.1972 : CO_2, 0.5738; H_2O, 0.1116
Calcd. for $C_{15}H_{14}O_2$: C, 79.64; H, 6.19. Found,
C, 79.35; H, 6.33.

[8] Meyer advises five to ten parts.

[9] Care should be taken not to exceed 100°.

[10] The first fraction will contain a small amount of thionyl chloride.

[11] Anschütz and Berns [*Ber.*, 20, 1389 (1887)] found 102.5° and 17 mm. for a product made from phosphorus pentachloride.

[12] This precaution gave a product that was more readily crystallized than otherwise.

o-Cresyl phenylacetate. This was obtained in 82 per cent. yield as indicated above. Two crystallizations from alcohol as described gave colorless plates; m.p., 44–45°. The product was identified by hydrolysis.

Anal. Subs., 0.2003 : CO_2, 0.5833; H_2O, 0.1137
Calcd. for $C_{15}H_{14}O_2$: C, 79.64; H, 6.19. Found, C, 79.41; H, 6.35.

Summary

1. A method for preparing the cresyl esters of phenylacetic acid has been described.

2. The melting point recorded by Poucher for the p-cresyl ester has been corrected.

SNAKES AND SNAKE PROTECTION*

By Louis Gershenfeld, Ph. M., B. Sc., P. D.

Professor of Bacteriology and Hygiene, Philadelphia College of Pharmacy and Science

(*Continued from the June Issue*)

GENERAL CHARACTERISTICS OF SNAKES. STRUCTURE

Snakes are scaly forms characterized as possessing long, narrow, cylindrical bodies devoid of limbs. The scales cover the entire head and body and their disposition is used as an important guide in the classification of snakes. In some few species (certain Boas and Pythons) tiny vestiges of hind-limbs are to be detected in the form of two or three small bones which support a small horny claw. Fore-limbs are never represented even by vestiges. The bodies usually taper towards the posterior end. It is startling to see how wide the mouth of a snake can be stretched. The mouth is capable of being opened widely due to the free articulation of the lower jaws, as the halves (rami) of the latter are not solidly united or fused together at the chin (symphysis) as is found among the lizards, but they are connected by elastic fibres or ligaments and are therefore capable of being moved or separated. The whole palatal apparatus is so articulated or connected to the skull as to permit of free movement. The

*One of a Series of Popular Science Lectures given at the Philadelphia College of Pharmacy and Science.

great distention of the mouth and throat made possible by this freedom of movement enables snakes to swallow objects entire and of large bulk. Movable eyelids and a tympanum (middle ear cavity) are absent. It is due to the former characteristic that one hears the statement made that snakes sleep with their eyes open. A sleeping serpent may therefore be awakened by seeing a sudden movement. The absence of eyelids, leaving the eyes glaring, accounts for the fixed stare possessed by serpents. Some observers believe that the latter may be the cause of the horror or dislike which humans have for snakes. The pupil is usually round but in the Boas and other species, it appears as a mere vertical slit. The eyes usually capable of considerable movement are covered with a transparent or glossy appearing cap, which is shed at each casting of the skin. Though there are no external ears, the sense of haering is present in all snakes, but it is not very good, and surely not so fine as the charmers would make us believe that snakes can differentiate between the different sounds made by their so-called music. The tongue in snakes, usually of a dark color or even black, is very long and slender or thread-like, and bifid or forked at the end. It is highly sensitive and is used chiefly as a tactile organ (organ of touch). The tongue cannot and does not "sting" as some are inclined to believe. It is said that snakes possess a remarkably acute sense of smell.

The vertebræ are very numerous, each vertebra hollow in front and convex posteriorly being connected with the adjoining one by free ball-and-socket joints, horizontal connecting projections preventing twisting though admitting of considerable vertical and horizontal play. Due to this arrangement and the concavo-convex centra. the backbone of a snake possesses considerable strength and extraordinary flexibility. The vertebræ bear ribs which may exceed many hundred pairs in number. A sternum (breast bone) and episternum, present in lizards, are absent in snakes. The ribs, therefore, cannot be attached or fastened at their inferior ends to a breast bone but they are attached to opposite ends of a series of large scales or scutes found upon the abdomen. The whole forms a mechanism for locomotion in the absence of legs and serves the purpose of a foot. It is with this arrangement that snakes crawl and wriggle and they have brought their method of progression to a high degree of perfection. The snake moves along by a series of horizontal undulations (waving motions), brought about by the contractions of the muscles inserted into the ribs, any inequalities on the surface of the ground serving as fulcra

against which the free posterior edges of the ventral shields (and which are connected with the ends of the ribs) are enabled to act. It is on this account that snakes are sometimes known as "rib walkers." Snakes therefore cannot and do not travel on a smooth surface. They cannot and do not move in vertical curves and climb trees in spiral fashion, which is the artistic but erroneous mode of representation of the movements of snakes. Like any twisted object it can glide, but its undulations are always horizontal. Snakes cannot and do not jump completely off the ground when attacking. Some snakes can raise the anterior part of their body and even move while in this position, but this is only a fraction rarely more than one-third of the total length which is erect or does not have contact with the ground, etc. Most snakes though extremely active and alert in their movements do not keep in motion for any length of time.

INTERNAL STRUCTURE

There are but few differences between the internal structure of snakes and other reptiles. The digestive system consists of salivary glands, a distensible gullet, stomach and intestines which terminates in an outlet transverse in structure. Snakes drink large quantities of water and also possess remarkable powers of fasting for long periods of time. Snakes like all reptiles have an elongated trachea, the wall of which is supported by numerous cartilaginous rings. The anterior portion is dilated to form the larynx. The trachea divides posteriorly into two branches forming two bronchi, right and left, one passing to each lung. The lungs are fusiform sacs, the inner lining of which may be raised up into a network of delicate ridges, having the appearance of a honeycomb. The lungs, ovaries and other paired or symmetrical organs exhibit an abortive condition or reduction in size of one of the pairs. In the snakes an abortion of the left lung is apparent. The heart consists of a sinus venosus, a thin-walled chamber into which the large veins open, returning the blood from the body. From this, an aperture, guarded by two valves, leads to the right auricle. There are two distinct auricles, the right receiving the venous blood and the left receiving the oxygenated blood brought from the lungs by the pulmonary veins. An important difference between the heart of the reptile and that of the amphibians is in the structure of the ventricle. In amphibians the ventricle is usually divided into right and left portions. In most reptiles, including snakes, the ventricular-muscular partition though developed, does not completely close off the left-hand portion

of the cavity of the ventricle from the right, so that we say that the heart of reptiles consists of three chambers, two auricles and a ventricle. The left-hand portion of the ventricle is much the larger and is further imperfectly divided into two parts.

REPRODUCTION AND AGE

The sexes are perfectly distinguishable. Snakes either lay eggs (oviparous) or produce their young alive (viviparous). Most snakes and a greater proportion of snakes than lizards are viviparous, the ova usually undergoing development in the interior of the oviduct, and the young reaching the exterior in the completely formed condition. Snake eggs usually having a parchment-like covering are generally oval in shape, and vary in size from a fraction of an inch to several inches in length. Eggs are usually deposited in loose earth, moist sand, decaying barks or wood—railway embankments are ideal places—and here the sun soon begins to hatch them. Parent snakes do not as a rule guard the eggs during this period, which in most instances takes four to eight weeks, hatching generally occurring in the late summer or early fall. Some species like the Pythons lay their eggs and coil about them until they are hatched. These eggs incubate among the folds of their bodies and hatch in about two months. The number of eggs laid or living young produced vary with the different species and differences in the size of those in the same species will likewise affect the numbers of offspring. As few as six and as many as seventy or more eggs or young may be produced. The snakes that are hatched, as well as the young produced alive by other species, show marked variations in size varying from a few inches to several feet in length. There is generally but one brood a year. The young of poisonous snakes possess perfectly formed venom-conducting fangs and glands and they are just as dangerous in proportion to their size as their parents. The age to which snakes live can only be approximated. If we are led to judge by their rate of growth in captivity, a 30-foot snake would probably approximate 100 years.

TEETH AND FANGS OF SNAKES

The jaws are provided with solid, elongated, single, thorn-like or sharp-pointed teeth, which are usually strongly recurved so that they appear like sharp hooks. All the teeth may be of the same character throughout and they are not lodged in distinct sockets but ossified to the jaws. They are never permanent and are capable of being

renewed. Their function is not to masticate but to hold the prey and prevent it slipping from the mouth while being swallowed. These teeth differ in various species mainly in the fact that they may be stouter or more slender, shorter or longer, or there may be fewer or show an increase in number. These characteristics and others as slight differences in structure are valuable aids in the classification of the Ophidians.

In the non-venomous snakes, the jaws and palate bear in continuous rows teeth as just described, but teeth are rarely developed on the premaxillæ. In the venomous snakes many or few of the maxillary teeth assume the character of poison-fangs. The latter, most frequently larger than the ordinary teeth and varying from one-quarter to one inch in length, are grooved or perforated by a canal (as in a hypodermic needle), for the passage of the duct of the poison-gland. The structure of the venom-conducting tooth or fang is not the same in all poisonous snakes. In the Vipers, the maxilla bears a single, large curved poison-fang with small reserve fangs at the base. The large poison-fang is capable of being rotated through a considerable angle and moved from a nearly horizontal position, in which it lies along the roof of the mouth embedded in the folds of the mucous membrane to a nearly vertical one, when the snake opens its mouth to strike its prey. In the venomous Colubrine Snakes, the poison-fangs are either the most anterior or the most posterior of a considerable range of maxillary teeth. Fangs are frequently lost, but these are quickly replaced by several spares which lie in a fold of tissue behind the working fang. When the latter is lost, one of these spares moves forward and in a short time becomes firmly cemented into the cavity of the lost tooth. The fangs themselves are shed at given intervals (about four times annually), but before it is loosened or lost, a new fang already grown in alongside of the old one becomes connected with the poison-gland.

When a venomous snake strikes, the poison is pressed out from the poison-gland by the contraction of the masseter (constrictor muscle), one of the muscles which raises the lower jaw. This is forced along a duct leading to the aperture entering the poison-fang and then injected into the wound made by the fang. The introduction of the venom by the fangs into the tissues or muscles is comparable to an injection of a poisonous agent given beneath the layers of the skin or into the muscles by a hypodermic needle to which is attached a syringe and to which pressure is applied.

POISON GLANDS

These are modified glands found in venomous snakes. They correspond to the parotid salivary glands of the higher animals and are situated on the cheeks behind the eyes, lying above the lip margin. The gland opens into a tubular duct, this terminating in a fringed membranous mouth. · In passing the fang this duct is connected to a sinus at the base or upper end of the fang.

STRIKE BY POISON FANGS

Venom does not flow freely from the fangs of poisonous snakes except during the act of striking. This is due to the fact that normally the opening between the duct and the base of the fang is compressed by a sheath, or a fold of mucous membrane. The introduction of venom from the poison-glands through the excretory ducts into the canals of the fangs is accomplished by the compression of a ligament. The compression of the poison-gland and the forcing out of this venomous fluid is accomplished by the same movement, which through a combined action of several muscles also opens the mouth and presses the horizontal pterygoid bones forward to erect the maxillaries with their fangs. The ejection of venom is a voluntary act and unless desired these muscles are not normally contracted sufficiently to force the poison from the glands.

The several varieties of poisonous snakes may display different actions when striking. The Pit Vipers literally stab forward, frequently with a terrific force and a lightning speed. The fangs are driven deep, quickly withdrawn and the snake draws back to a position of defense or to await the death of its victim. The Elapine Snakes with their small immovable fangs do not stab, but bite and chew for several seconds with the view of letting its less effective, shorter fangs become embedded as deeply as possible and thus enable the venom to get into the deeper tissues and exert its effect.

If the object to be struck is beyond the reach of the venomous serpent, the entire stroke may be completed without touching the object of attack. At most the snake strikes about one-half its length when delivering an accurately aimed blow. It is only after an exceedingly large amount of excitement that a poison snake may strike a distance equal to more than one-half and rarely over two-thirds of its length. It never springs bodily, that is, its whole length, at any object it is about to attack. It usually strikes a much shorter distance in proportion to its length.

In case the object of the snake's anger is too close, the most frequent occurrence is to find that the fangs have not penetrated deeply if at all as when striking, the fangs were not fully erect.

OCCURRENCE AND HABITS

Reptiles were more widespread in ancient days than they are now. It is probable that Central Asia was the region where most members of this class were to be found and from here they spread by the various facilities available for migration.

Reptiles, and snakes in particular, are confined in large numbers to the tropical and semi-tropical areas. They are also found in the temperate regions, but in the latter where the winter and freezing weather prevail for long periods of time, only small numbers are observed. The number of species of individuals steadily decrease in the cooler temperature zones but few being found in real cold regions. They range much farther in the latter areas than do lizards. Most all countries in the tropical and semi-tropical areas harbor snakes with the exception of few isolated islands as the Azores and the Hawaiian Islands. Just as with their general distribution so in their mode of life and habits, marked variations are to be found. Snakes are found everywhere, in the hills and mountainous regions, deserts, grassy plains, fields of all kinds, sand, on trees, in forests, in fresh water, in the sea, etc., and so we have:

Burrowing or Subterraneous Snakes, which live underground and are but infrequently found on the surface. They burrow into the ground like worms and feed chiefly on invertebrate animals, especially ants, and none are poisonous. They tend to become eyeless, even tailless, and they possess smooth instead of overlapping scales.

Ground or Terrestrial Snakes comprise the largest number of the several species and are the types which we observe more frequently. The majority of snakes in this group are non-poisonous, though the greatest number of all of the poisonous snakes are to be found here. Due to their habits, and especially during feeding when they seek seclusion so as to assimilate food, snakes are not commonly observed in as large numbers as actually present.

Tree or Arboreal Snakes pass the greater part of their existence on trees and are capable of climbing bushes, trees, etc. They usually have slender compressed bodies and long tails and therefore appear whip-like. Their coloration usually resembles that of their surroundings. They feed on animals leading an arboreal life. Some species

are poisonous. Certain species of Arboreal or Tree Snakes are known as "Flying Snakes," so named from their habits of parachuting down to the ground from the top of the tree where they reside.

Freshwater or Semi-aquatic Snakes live in or frequent fresh waters. They are agile swimmers. They feed on fish, frogs, and other aquatic animals. They are viviparous and most all species are non-poisonous.

Sea, Marine and persistently Aquatic Snakes are unable to move on land. They are viviparous, feed on fishes and most species are poisonous.

Snakes are the most stationary of all vertebrates, rarely changing a locality if the proper food and shelter is present. Some species may be limited to a sharply restricted environment or local area while others adapt themselves to wide ranges of territory.

FOOD FOR SNAKES

The food of snakes varies considerably. Other than mentioned, the terrestrial snakes display different fondness for various foods. Some snakes prefer a species of snake other than its own (cannibalistic) or they eat lizards. Small snakes eat slugs, earthworms, frogs, toads, or insects as beetles, crickets, caterpillars, grasshoppers and grubs. Larger snakes feed on mice, rats, ground squirrels, rabbits, possums, rodents, birds, and in the case of Pythons, etc., on chickens, and mammals even as large as pigs.

The Pythons and Boas kill their prey by constriction, winding their body closely around it and drawing the coils tightly till the victim is crushed or asphyxiated. Some other non-venomous snakes kill with bites of their numerous sharp teeth. The venomous snakes sometimes when the prey is a small and weak animal, swallow it alive, but they usually kill it with the venom of their poison-fangs.

Snakes don't feed often, though in some few instances this may be daily. Weather conditions and the size of its previous meal are factors which influence the frequency of feeding. A Boa kept in Paris holds the record of having fasted forty-nine months. Most all snakes eat in the same manner. They pull their flexible head over their prey, each of the four jaws catching hold by turn as they push forward one at a time. The process of swallowing is a more or less mechanical one. It is interesting to observe that a snake almost always starts its meal on the head end of its prey.

INTELLIGENCE OF SNAKES

The brain of reptiles is more highly organized than that of amphibia. We know of several habits and actions of snakes, either when attacked or when living normally, which apparently simulate degrees of intelligence. There are some habits and gestures in certain species of snakes, which we know as mimicry, and which serve a helpful purpose for the snake by usually making it look more dangerous than it really is. Their cunningness when attacked is known to all. We must frankly admit that we don't know whether these and other actions are merely instinctive or governed by acts of reasoning, though herpetologists are inclined to credit snakes with some reasoning powers, based upon their own experiences and that of the observations in the several Zoological parks where snakes are in captivity. Experiences related by many about the King Cobra are interesting and suggest an ability to reason. Perhaps during this age of the intelligence test with the interest taken recently in the study of reptiles, the snakes, like the automobile driver, the army recruit, and the college student will have an intelligence test especially prepared for them at the serpentarium or at some laboratory. Then perhaps we will know more as to their attributes and intelligence, their instincts and capacity for action, their efficiency and their organization and as to whether certain actions concerning which we are familiar are instinctive or whether they are the products of a certain amount of reasoning which perhaps might be classed as intelligence.

SIZE

Variations in size as in structure is more marked among snakes than among the other reptiles. Burrowing snakes having the thickness of a goose quill and a length of from 3 to 5 inches are to be found, and on the other hand, there are species of Pythons from 20 to 30 feet or the Anaconda, monarch of the Boas, credited with a length of 40 feet and higher with a proportionate girth.

HIBERNATION

Snakes are extremely sensitive to cold. They do not possess feathers, fur, or the protective coat of a mammal, and thus they cannot protect themselves against cold weather so as to remain active when the latter prevails. They must therefore hibernate or remain inactive for long periods during the cold months. In real cold climates, their only chance of survival is to burrow beneath the frost line and remain there until cold weather is over. If they don't possess burrowing ability they die. In temperate climates,

snakes spend the winter sleep in burrowing beneath the ground for a short distance. Others may find their way in cavities in trees, while the rattlesnakes and moccasins and other species of snakes find their way into the cracks and crevices of rocks, in which they hibernate. Snakes do not hibernate in warm climates. Here, on the other hand, we do hear of certain species which may succumb due to intense heat. Hibernation of serpents in cold areas results in a most interesting observation. Many of the same species congregate in considerable numbers at specific "dens" or places. They come from great distances each year to this same area, guided probably by the same instinct that results in the migration of a flock of birds.

SHEDDING SKINS

All vertebrates shed their skins. The process may be gradual and almost unnoticeable in some mammals. Healthy and well-nourished snakes shed in one piece their entire skin, which is thin and overlays their scaly covering. Along with this epidermis in the one piece is to be found that covering the cornea of the eye, so that this is shed whole. The outer layer of the epidermis during shedding as it is cast entire is turned inside out in the process. The frequency of this shedding varies in different species and in the same individual at different ages and is also dependent upon other factors as weather conditions, health, etc. Ordinarily in temperate regions, at least two sloughs are cast in a season, one in the spring and another in the late summer. In warm climates, this event may take place at intervals of two months apart. Before the shedding commences the color of the serpent fades and the eyes become white or milky due to the separation of the outer layer of epidermis from the cornea. This results in an impaired vision and has given rise to various nonsensical superstitious and mythical stories.

PROTECTIVE DEVICES OF SNAKES

Many species of snakes seem to be endowed with elaborate or spectacular devices which in most cases apparently serve the sole function of frightening away an aggressor. Whether these developments are employed between snakes for purposes of signalling each other or whether they may serve the snake in any other capacity is not definitely known.

The Cobras are well known for the manner in which they spread out or distend the sides of the neck and head when disturbed or irritated. In the Cobra de Capello or the "Bespectacled Cobra," one will find that there are several loosely articulated ribs, which are moved

by muscles found on the sides of the neck. These interior ribs of the neck expand or are drawn forward by the muscles so that the anterior part of the body or the region behind the head spreads out to a marked degree, giving the appearance of an overhanging arch or hood. On the middle of the latter, posterior to the eyes, is a greenish yellow marking, resembling the rim of a pair of spectacles, thus the name "Bespectacled Cobra." When alarmed, the Cobra raises the anterior part of its body, so as to attempt to stand erect, expands its hood and waving its body from side to side it is made to appear much more threatening than it would otherwise be. Apart from the Cobras, there is the Mamba, a poisonous arboreal snake, and several species of harmless snakes, the Theletornis of the Congo, and our own the Blow Adder or the Hog-nosed Snake, which are able to raise the anterior part of their bodies vertically and expand their necks in a manner imitating somewhat the dreaded Cobras. These harmless snakes create considerable fear among the uninitiated.

The vibration of the tip of the tail is common among several species of snakes. The use of the rattler and the spitting of venom as means of frightening away an aggressor will be mentioned. The habit of curling up like a ball to protect its head is common among many species of snakes, especially among some of the Boas. The hissing by snakes in which the sound is even as loud as that of escaping steam prevails among those species having a large lung capacity and possessing powerful muscles. Horns on eyelids, and in rarer instances on the nose, spines on the tail, and different devices possessed by burrowing snakes to dig up the sand and sink out of sight are to be found on different species of snakes. The emission of secretions which possess an unpleasant odor is practiced by few species of snakes and this actually serves as a protective device, inasmuch as one is not prone to handle these specimens.

The power of maneuvering the muscular body so as to kill their prey is possessed by the boas, pythons and other species as the chicken snake and the pilot black snake. The crushing powers are greatest at the hindermost part of large constrictors, as the pythons.

POISONOUS SNAKES

It is, of course, the venomous or poisonous snakes which really play the most important role in the relation of reptiles to man and the higher animals. In some instances, and in particular in tropical and semi-tropical countries, the problem of ridding environments of poisonous snakes is a

unique and important problem. Even here in our own country, we must be prepared to cope with these creatures. Without taking into consideration that poisonous snakes are to be found in mountainous and swampy areas, on farms and in sparsely populated districts, there are instances where especially due to the facilities of travel these creatures may be found literally at our door. At such times, a differentiation as to whether the reptile is poisonous or non-poisonous will be of considerable value. For instance, I have several recent newspaper clippings before me. One gives a report of a merchant in our own city finding in his cellar a snake six feet in length and as thick as a man's arm. After an investigation, it was concluded that the reptile arrived with a shipment of fruit and found its way into the cellar through a break in a partition which divided his basement from that of a fruit store next door. Another clipping from a well-known national weekly known for the accuracy of its contents, tells of a baseball fielder at Chapel Hill, N. C., who ran to retrieve a home run and as he leaned to pick up the ball from a tuft of grass, a snake bit him severely in the hand and POISONED him. Still another gives an account of a brown and white snake, 15 feet long and weighing about 75 pounds, which was captured in a third-story apartment on Eighth Avenue, in New York City. The capture required a squad of six policemen, who struggled for one hour before it was finally subdued and removed. I have before me a copy of a report from Police Commissioner Joseph A. Warren, of New York City, relating the details of this capture and investigation together with a copy of a report from Dr. Raymond Ditmars, the world renowned herpetologist from the New York Zoological Society, who identified the specimen as a member of the Pythons, a non-poisonous snake. This investigation also revealed that the snake escaped from a cage next door, where it is kept and used in an act in various theatres. The snake entered by way of the fire-escape. Many of the Zoological parks receive Copperheads and Rattlesnakes sent in by individuals who catch them practically within city limits.

Without citing other cases which I have before me, you may nevertheless observe that this problem may frequently reach close to home. And then remember that our prairies become farms and ranches and finally these become settled more thickly and the right of men to live and possess the land being greater than that of the animals it seems inevitable that the fauna of this area must leave, die or be killed. Until this happens and the possibility of its arising is

far off, we will have poisonous snakes about us, and when hiking, hunting, camping or working or even fishing in these areas, one must be on the lookout for poisonous reptiles. The degree of danger from a bite depends not only upon the species which has inflicted the wound, but on the size of the particular species, the amount of poison deposited, and the place where the wound was made. The mortality in children bitten by poisonous snakes is greater than that of adults, for the same amount of poison is deposited by the venomous snake whether a child or an adult is bitten. Like all poisons, the deathly effect of the venom is in proportion to the body weight; an amount which when injected into a large body or that of an adult may not prove fatal would, however, in the same dose, kill a child.

Excluding the Sea Snakes, which are merely Water Cobras, and all are venomous, there are about 250 other species of snakes which have a well-developed poison apparatus. About one-third of this number may be disregarded, due to their small size or rarity, leaving the remainder as the total number of poisonous species which are of some concern to humans and higher animals.

Accurate statistics are not available from most of the countries infested. In European countries, where there are many poisonous species, and where records are not kept, there seems to be but few fatalities. In Africa, while the poisonous species are abundant and even dangerous, they seem to remain confined to the Jungles or sparsely settled areas, so that there seems to be no great loss of human life. Here also statistics are not available. The regions where most fatalities occur are in the order of the greatest losses: India, Southern Brazil and Australia. In Central America and North America there are more casualties than there used to be and only recently campaigns have been started which promise to result in a marked reduction of poisonous snakes and in the saving of all lives bitten by any of the latter in these areas.

The loss of live stock and higher animals other than man can only be guessed at, as no reliable statistics are available, but there is no doubt that this runs up into the millions of dollars annually. You must remember that all of the natural habits of all varieties of poisonous, and even many of the non-poisonous snakes, may not be known. For obvious reasons, which you can surmise, all of them may not be known, as close studies cannot always be made under natural conditions. Not all types of snakes can be kept in captivity and then again their actions under such conditions are most frequently modified or

changed. For instance, there is a little data available concerning diseases of snakes except when in captivity, where various diseases, especially mouth infections, are known.

POISONOUS SEA SNAKES

The Sea Snakes or Marine Serpents comprise over fifty species of several genera belonging to the Hydrophiinæ. They are all strictly marine, very poisonous, the most deadly of snakes, viviparous, of various sizes, and striking coloration. They are provided with a rudder-like tail and nostrils on top of the head closing with valves. They abound in the Indian Ocean, and in all warm and tropical waters except the Atlantic, being mainly confined to the Old World. A single species, the Yellow-bellied Sea Snake, found in the Old World, is also common in the Bay of Panama and in the tropical waters off the west coast of Mexico, Central and South America. Though rarely met when swimming, this species is dreaded by fishermen, who frequently haul up specimens in their nets.

POISONOUS SNAKES IN INDIA

Tropical India is rich both in the number and different kinds of snakes. Though accurate statistics are uncertain, it has been estimated that approximately 20,000 natives die annually in India from the effects of bites by poisonous snakes, this in spite of all attempts to exterminate these creatures. One of the reasons accounting for this great loss is that the poisonous snakes lie in the roadways so as to be baked by the sun. They are prone to lie there even for days at a stretch. The Indian folks have a habit of walking on these roads by night to get the cooler breezes. Usually barefooted and therefore unprotected, they come across these snakes and are bitten. In most cases, capture of the snake is impossible, so that identification of the species in turn is out of the question. Chance for a cure is likewise markedly reduced, for even though antivenin may be available, it is impossible to know whether to give antivenin for the prevalent species of Cobra Snakes, the antivenin for the prevalent members of genus Bungarus or the Kraits or the antivenin for Russell's Viper, as each one is specific and Cobra antivenin will be valueless for the venom of other snakes and vice versa.

The Cobras seem to occupy in the minds of laymen the position embodying the deadliest of evils. Yet strange enough, the two species of this genus found in India, Naja tripudians (Spectacled Cobra) and

Naja bungarus (King Cobra) do not cause as many deaths as do the various species of Bungarus, especially the dreaded Krait, Bungarus cœruleus, and the deadly viper, Vipera russellii, known also as Tic Polonga, Baboia or Russell's Viper. The Kraits and Russell's Viper lie more quiet, are not as active and less inclined to move out of the way than the Cobras. The Cobra is held sacred in many sections of India. They have even come to lead a semi-domesticated existence, and it is not an uncommon occurrence to find one or even several about a village temple.

POISONOUS SNAKES IN AUSTRALIA

Australia is one country where the poisonous snakes are in the majority. Many species are small and rare. Most of the dangerous Australian snakes are members of the several genera belonging to the Elapinæ, the same subfamily to which the Cobras and their allies and the American Coral Snakes belong. The Death Adder (Acanthophis antarcticus), the Tiger Snake (Brachyaspis [Hoplocephalus] curtus), the Brown Snake (Diemenia superciliosa) and the Black Snake (Pseudechis porphyriacus) are some of the dangerous serpents found here.

POISONOUS SNAKES IN TROPICAL AMERICA AND BRAZIL

Poisonous snakes abound in Brazil. The latter was the first country to attack this problem scientifically and systematically, obtaining results that are worth while. Accurate statistics are not available from Northern Brazil, so that results that are reported are obtained after using as a basis the statistics of the State of Sao Paulo in Southern Brazil, where the government established in 1899 the Seropathic Institute of Butantan. Where twenty years ago there was on an average of 5000 humans (leaving out of account farm animals) killed annually in Brazil, last year with a population of four times as great, less than sixty deaths occurred. This is due partly to the propaganda on behalf of the wearing of shoes, systematic destruction of the pests, and due to the use of the antivenin by those bitten.

There are approximately twenty-three species of poisonous snakes found in Brazil, most of them belonging to the genus Lachesis (Bothrops), pit vipers belonging to the subfamily Crotalinæ. Here we find the Fer-de-lance (Bothrops atrox) (Lachesis lanceolatus) and that terrible dangerous creature the Sirocucu, Surucucu, Mapepiré or the Bushmaster, the largest of the Crotaline serpents and the only important species of the latter which lays eggs.

In tropical America, poisonous snakes are not commonly observed. The problem of their control seems to concern mainly industrial and commercial organizations who employ men in jungle labor. It is here when the jungle is being cleared or plantations are being cleaned, that poisonous snakes appear and are a menace to the barefooted laborers. The Fer-de-lance, known also as the Barba Amarilla, Terciopelo, Jararacá, Mapepiré balsayn is perhaps the most common species of the many species of pit vipers to be found here and does most of the harm. The South American Rattlesnake Crotalus terrificus and the Bushmaster are found but infrequently. The many species of Coral Snakes, though present and extremely dangerous, are generally of little concern, as they possess a mild disposition.

There is a possibility that in the near future, deaths caused by snake bites in the tropical Americas will be a rarity, for a comprehensive anti-snake-bite campaign has been under way for the past four years in an organization which has an experimental research station and serpentarium at Tela, Honduras. In this organization the following cooperate, the United Fruit Co., Dr. Thomas Barbour through the Harvard Museum of Comparative Zoology, and Dr. Afranio do Amaral through the Antivenin Institute of America.

POISONOUS SNAKES IN NORTH AMERICA

From a scientific standpoint, we have to regard all snakes as poisonous if they yield venom which is capable of producing some toxic action in contact with the body tissues of humans and animals. Practically, however, some of these apparent poisonous reptiles are not as dangerous as they appear, because of the fact that though they secrete venom they but rarely attack man, and when they do they are unable to inject the poison deep enough into the tissues to exert any serious effects.

There are nineteen different species of poisonous snakes in North America and they are included in two groups. One is the proteroglyphs (front-fanged snakes with grooved teeth), a section of the Colubridæ, and the other is the solenoglyphs (highest stage evolution of poisonous fang and possessing maxillary teeth which embrace a longitudinal tubular duct), comprising mainly the pit vipers found in the subfamily Crotalinæ, family Viperidæ. The proteroglyphs include two subfamilies, the Poisonous Sea Snakes (Hydrophiinæ) and the Elapine Snakes (Elapinæ). The Elapine Snakes include the Cobras and their allies and the Coral Snakes. There are no Cobras

or Cobra-like snakes in North America, but the closely related Coral Snakes are to be found in this hemisphere. Of the many species of Coral Snakes only two are found in this country.

In the United States proper, practically every state is inhabited by venomous snakes with the exception probably of Maine and New Hampshire. In the other states, when we consider the convenience of travel, we can literally state that poisonous snakes are in "our midst." It is interesting to note that in the northern states, though poisonous snakes are plentiful, they don't seem to be so vicious and possess a milder temper.

CORAL SNAKES The two species of Coral Snakes, the Harlequin Snake (Micrurus [Elaps] fulvius) and the Sonoran Coral Snake (Micrurus [Elaps] euryxanthus) are frequently confused with non-poisonous snakes. The main point of differentiation,

Micrurus fulvius, "Harlequin Coral Snake."

of course, lies in the fact that the Coral Snakes possess a pair of short, stout, longitudinally grooved fangs (therefore known as proteroglyphs), one on each side, in the upper and front part of the mouth. Each fang is rigid in its position, does not fold against the roof of the mouth and in fact is practically devoid of any motion. After some experience in the observation of the gross appearance of snakes, one will also find that the loreal, a plate found on each side of the head of most harmless snakes is lacking among the members of the Coral Snakes.

The poisonous Coral Snakes, so called because of the presence of broad, bright, coral red rings, are of moderate size, possessing a cylindrical body, each broad crimson marking being followed by a broad black marking, and both separated by a narrower yellow ring. The blunt head is as wide as the neck and therefore not distinct from it. They have a comparatively small mouth and possess a rather amiable

temperament. Their length is rarely over 2½ or 3 feet. The Harlequin Snake or the common Coral Snake is found in humid places from Northern North Carolina to Florida and westward through the Gulf States through Mexico and thence into Central America. It may occasionally be found in the Mississippi Valley as far north as the lower borders of Ohio. The Sonoran Coral Snake is much smaller and is not found as frequently as the other species. It is found in the Southwest, between the Rocky Mountains and the Colorado River, mainly in California, Central and Southern Arizona, New Mexico and Sonora, Mexico. Both species are oviparous, feed on snakes and lizards, and like all species of this genus they are of burrowing habits. They may be found under the ground, hiding under decaying logs, and come forth for food, and are seen in large numbers after heavy rains.

It is a common occurrence to find that these two species are mistaken for different varieties of harmless snakes, especially the following: Scarlet Snake (Cemophora cocconea), Scarlet Kingsnake (Lampropeltis elapsoides), Milk Snake (Ophibolus doliatus), Western Milk Snake (Ophibolus doliatus Gentilus), Arizona King Snake (Ophibolus zonatus), etc. Though most of these species of harmless snakes have rings possessing the same colors, the disposition of these rings is different and when once recognized, it becomes a simple matter to distinguish between the poisonous and harmless snakes. The yellow rings of the poisonous snakes always border the black rings, while among the harmless snakes there are two pairs of black rings bordering a yellow one. The bands of color with the poisonous snakes completely encircle the body, while in many of the harmless imitators the abdomen is white or blotched.

Due to the secretive nature of these poisonous Coral Snakes and due to the fact that the latter do not bite unless stepped on or annoyed, bites by these reptiles occur but infrequently.

THE PIT VIPERS The Pit Vipers belonging to the subfamily Crotalinæ (family Viperidæ) are solenoglyph snakes and are so named due to the presence in all species of a small deep pit or cavity in the loreal region just before the eye, in other words, a hole is found on each side of the snout between the eye and the nostril. This is never found in the other snakes. The pit itself is heavily innervated, but the exact function of this cavity is unknown. It, however, serves as a valuable and constant guide in identification, for the presence

of a pit marks a snake as a poisonous reptile. The fangs are very long and are provided with an elongated orifice, hollow as in a hypodermic needle. They are situated one on each side in the upper and front part of the mouth, and though rigidly fastened to the maxillary bones, they move with the latter, which are but loosely attached to the skull and very closely connected with powerful muscles. Each fang is connected with a gland, situated behind the eye and which contains the venom. The following genera are listed in this pitted group:

Agkistrodon (Ancistrodon), which contains the important Copperhead Snake (A. mokasen or A. contortrix), and the Cotton-mouth or Water Moccasin (A. piscivorus), the two important poisonous snakes found in this country; Lachesis (Bothrops) containing species found chiefly in CENTRAL and South America and none in North America. The Fer-de-lance, the Bushmaster and closely allied species are listed here. Sistrurus, the Pigmy or Dwarf Rattlesnakes, containing two important species, and genus Crotalus, the Rattlesnakes, containing thirteen important species of poisonous snakes found in this country are the other important genera. In all, this makes a total of seventeen important species of Pit Vipers or Crotaline Snakes which, with the two important species of Coral Snakes, make a total of nineteen species of poisonous snakes found in this country.

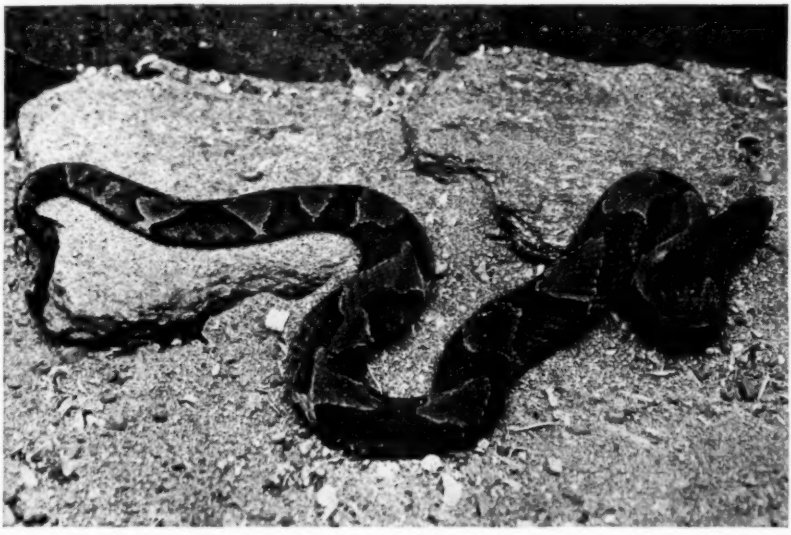
GENUS AGKISTRODON (Ancistrodon)

In addition to the characteristics mentioned previously concerning this and the other genera of Pit Vipers, the additional information which follows will be of value.

The Copperhead and Cotton-mouth Moccasin, members of genus Agkistrodon, possess head plates which are covered with large shields. This may be similar to that observed in some of the harmless snakes, but the latter are easily distinguished from the poisonous serpents due to the presence in the latter of the pit and the elliptical pupil of the eye as compared to the round pupil present in the eye of the harmless snakes. By their head plates, they appear as do members of the genus Sistrurus, also containing pit vipers, but the latter contains a tail with rattle not present among species of Agkistrodon.

The Water Moccasin or Cotton-mouth Snake is large and stout, in fact, it is one of the largest poisonous snakes found in this country. It possesses an obscure color pattern in dull olive with wide, black transverse bands and a head which is very distinct from the neck. It is found in swampy areas or even in water, especially in the South-

eastern and Gulf States, into Eastern Texas, and is a frequent visitor in rice fields. It may also be found in those states bordering the Mississippi River and its tributaries extending northward to Southern Illinois and Indiana. Due to its semi-aquatic habits, bites from the Water Moccasin are not of frequent occurrence. Surprised suddenly, this snake generally draws back its head, opens its mouth and glares in hostile fashion. It may strike at once, but as is more often the case, it quickly overcomes its first start of surprise and will attempt to slip away and escape.



Agkistrodon mokasen, "Copperhead."

Agkistrodon mokasen (Ancistrodon contortrix) is frequently known also as the Copperhead Snake, Highland Moccasin, Deaf Adder, Pilot Snake, Chunkhead, Rattlesnake Pilot, Pilot Snake and Poplar Leaf. It is said that when pregnant a large number of females will at times twine themselves together, which accounts for the name "contortrix. It is pale, hazel brown, possessing large cross-bands of rich reddish-brown, which are narrow on the back and very wide on the sides. The head paler in color than the rest of the body usually displays a coppery tinge, thus the popular name of Copperhead. This serpent, averaging three feet in length, inhabits the eastern and central portions of this country, generally from Massachusetts to Northern

Florida, thence westward, reaching from Illinois to Texas. It is found mainly in hilly and rocky areas in high and dry ground, though it may be found near streams. The fangs of this species, as well as that of

Agkistrodon piscivorus, "Cotton-mouth Moccasin."

the Water Moccasin, are rather small in proportion to the size of these snakes. The Copperhead is a dangerous poisonous snake, but it may not cause considerable annoyance, because of the fact that it is not aggressive, will always attempt to glide away and will only strike when

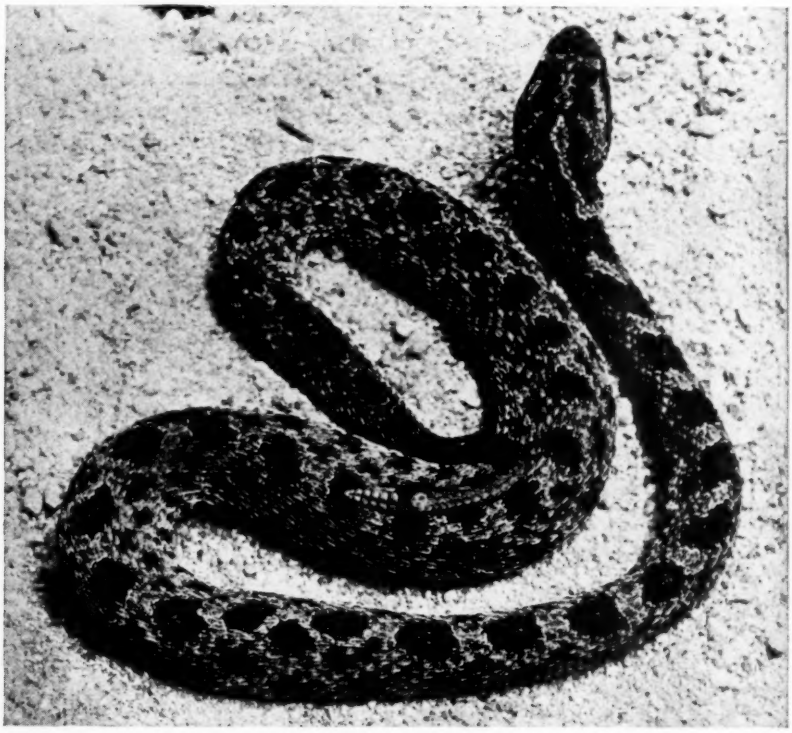
approached closely or caught at close quarters and escape is impossible. The Copperhead ejects but a small amount of venom, but the latter is very poisonous. Of the 601 cases of snake bites reported in this country during 1928, 167, or almost 28 per cent. of them, were caused by Copperheads.

RATTLESNAKES The Rattlesnakes are the most important of the poisonous Pit Vipers found in this country. As a group they are also very interesting and attract much attention due to their colors, habits and actions, and especially due to the characteristic horny rattle appended to the tail, by the presence of which species of Rattlesnakes are immediately recognized. The particular or exact species is immaterial. As long as the caudal appendage the rattle is present, one should know at once that such a snake is poisonous and dangerous. The Rattlesnakes are divided into two genera, Sistrurus, Pigmy or Dwarf Rattlesnakes, and Crotalus, the Rattlesnakes.

GENUS SISTRURUS The Pigmy Rattlesnakes are distinguished from the other rattlers by the fact that the tops of their heads are covered with large, symmetrical shields, while in the rattlers the head tops are covered with scales. The head top arrangement with shields is also observed in many of the non-poisonous snakes, but the latter do not possess the characteristic pit and rattle present in these poisonous snakes. Only two important species, the Massasauga and the Pigmy Rattler, are of any concern in this country. The Massasauga is represented by two races:

(1) Sistrurus catenatus (Massasauga) and Sistrurus catenatus variety edwardsii (Edward's Massasauga). The common ground color in the former is grayish-brown, with large brownish black blotches on the back and a series of smaller blotches on each side of the body. This variety averaging about two feet in length, is found in the swampy regions ranging from Western New York through Southern Ontario and Southern Michigan to Kansas. Edward's Massasauga possesses a much paler color and smaller spots on the back. The rows of scales are a few less in number, but otherwise it resembles the typical Massasauga. It is not quite as partial to damp places and is found in Western Kansas, on through Oklahoma, Western Texas, Southeastern Arizona and through Northeastern Mexico.

Sistrurus miliarius, the Pigmy Rattler, also called Southern Pigmy Rattlesnake and by the popular but misleading name "Ground Rattlesnake" or "Florida Ground Rattlesnake," is a much smaller snake than the Massasauga. It possesses a dark ashy gray color with large black blotches and is found in dry ground among leaves or in grass, distributed from Southeastern North Carolina to and throughout Florida, west along the coastal region of the Gulf of Mexico to



Sistrurus miliarius, "Pigmy or Ground Rattler."

Western Texas and Oklahoma, and northward through the valleys of the Mississippi River and its tributaries to Arkansas and Southern Missouri. The Sistrurus ravus, a third species, found in the lowlands of Eastern Mexico, shows about the same habits as the Massasauga.

Owing to the diminutive size of the Pigmy Rattler and the Massasauga, the amount of venom secreted by them is usually small. They are accordingly the least formidable of the North American poisonous snakes.

GENUS CROTALUS The Rattlesnakes (Proper)

The species of this genus of Pit Vipers do not have the head top covered with shields but with small granular scales. There are approximately fifteen distinct species and several varieties found in this country, but only thirteen species are of importance. The latter are distinguished from each other by one or more of the following characteristics: differences in color and markings, variations in size, and presence or absence of horns over the eyes. It will be impossible to consider here technical differences. All that will be presented are the scientific and common names of the important species, statements of their ranges and some general characteristics.

Crotalus adamanteus—The Diamond-back Rattler is the largest of the Rattlesnakes, reaching a length of from six to eight feet. It possesses huge fangs with a large opening at the tips and enormous poison glands. It is found about swamps in the area extending from Southern North Carolina to and throughout Florida and on many of the keys and thence westward to the Mississippi River. The action of the venom of this species is very severe, causing considerable annoyance if death does not result. This is one species that but infrequently glides away if disturbed. It is perhaps the most courageous of North American serpents. Their body colors blend with the vegetation, so that they are at times observed only with difficulty. They are viviparous, and though feeding on all rodents, their favorite food is wild rabbits.

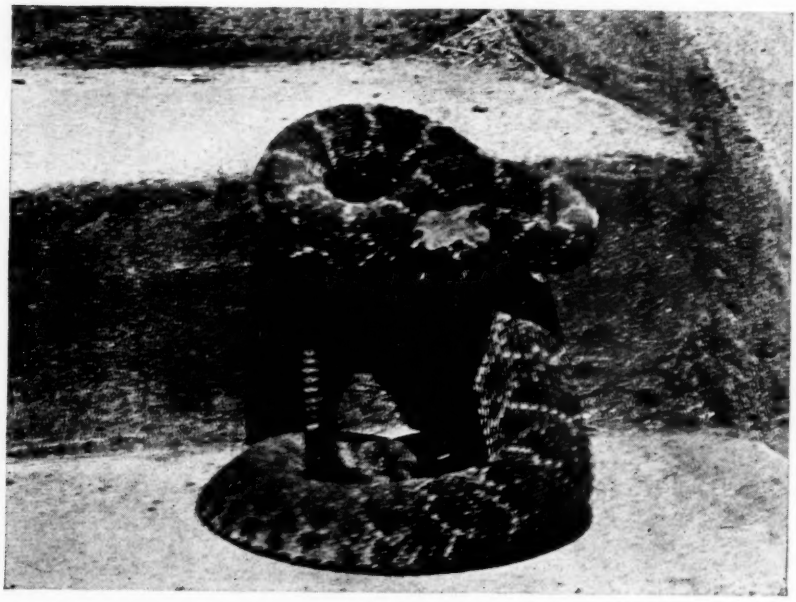
Crotalus atrox, the western Diamond Rattlesnake, averages about 5 to 7 feet in length. It is found in dry (sandy, desert) areas, rocky places, and in agricultural districts, its range extending from Texas to Arizona and California and south into Mexico and Lower California.

Crotalus cerastes—the Horned Rattlesnake or Sidewinner is one of the smallest members of this genus and is readily distinguished from the other Rattlesnakes by the prominent horn-like process over the eyes, which is in reality an elongation of the upper eye-shield (supraocular). This species is found in the sands of the desert areas of Arizona, Southern Nevada, Eastern and Southern California and Southern Utah.

Crotalus confluentus—the Prairie Rattler is a commonly found vicious reptile of moderate size. It is a typical snake of the prairies and is found in the region of the Great Plains from Southern Canada to Texas and west to a little beyond the Rocky Mountains. It feeds

on all kinds of small rodents and its habits of prowling into burrows to devour any young has been responsible for the incredible tale of the closer relations existing between the prairie dog and this rattler.

Crotalus exsul, known as the Red Rattler or Red Diamond Rattlesnake, is a handsome snake of fair size, averaging close to 5 feet. The color as well as the markings are employed to distinguish between this and other species of rattlers, especially the Western Diamond-back Rattler, to which it is closely related. It feeds on rodents and is found in rocky places, usually about cactus groves, and



Crotalus atrox, "Western Diamond Rattlesnake" (showing position for striking).

its range extends from Southern California into Mexico, Lower California and the islands of the Gulf of California.

Crotalus horridus, known as the Banded or Timber Rattlesnake, the Black Rattler and Canebrake Rattlesnake, is one of the commonly found species of the Rattlesnakes. Its range is extensive being found over the northeastern states, thence south to the northern portion of Florida and west to the Great Plains. It occurs most frequently on mountain ledges or in the crevices of rocks and in timbered or woody and hilly regions. This species is not very irritable, and prefers flight to combat. Like all Rattlesnakes this species is viviparous and feeds

on warm-blooded prey, usually all sorts of rodents, but occasionally birds.

Crotalus leipidus, the Green Rattler, is the smallest species of this genus and is found in mountainous areas. Though rare, its range extends from Western Texas, through Southern New Mexico and Arizona and the adjacent territory in Mexico.

Crotalus mitchelii, known as the Bleached Rattler, Pallid Rattlesnake, the White Rattlesnake, or Mitchel's Rattlesnake, is frequently mistaken for other species which it resembles. It exhibits a wide variety of coloration. This species is found mainly in rocky places, and around cactus groves and all kinds of thorny shrubs and its range is from Arizona to Southeastern California and Lower California.

Crotalus molossus, the Black-tailed Rattlesnake, which is readily identified because of the uniform jet-black of the tail, is of moderate size and is found around rocky ledges, its range extending from Western Texas to Southern Arizona. It is also found in the highlands of Northern Mexico.

Crotalus oreganus, known as the Pacific and Black Rattlesnake and in some areas even as the Black-Diamond or Diamond-back Rattlesnake and erroneously called Crotalus lucifer, is similar in many ways to the Prairie Rattlesnake. This species may show marked variations in coloration. It is found in mountainous and timber districts all over the West Coast from British Columbia to Southern California and east to Western Idaho, Nevada and Arizona.

Crotalus triseriatus, the Spotted Rattler, incorrectly known as Crotalus pricei, is a small species of Rattlesnake found in the mountainous areas of Southern Arizona and the central plateau of Mexico.

Crotalus tigris, the Tiger Rattlesnake, is found in the mountainous areas of the extreme southwest. It is probably not a very vicious species, and seldom attains a length of more than three and a half feet.

Crotalus willardi is another small species of rattlesnake found in the Santa Rita Mountain region of Arizona, and Northern Mexico.

SNAKE PROTECTION PRECAUTIONARY MEASURES AGAINST AND CONTROL OF SNAKES

When hunting, hiking or fishing or working in fields and plantations, observe where you walk and where you put your hands. If you are visiting areas where poisonous snakes are known to abound, protect your hands with gloves and wear leather leggins, or better still, rubber boots specially constructed with a shank and several layers of canvas. Frequently a pair of leather puttees

beside the shoes will be sufficient protection. Don't pitch a tent in the vicinity of rocky ledges, swampy areas, or where tall grass is plentiful, but use a clean site. If you find that you are to sleep in this tent more than one night, arrange to hang your bedding or clothing or keep them wrapped or well covered, preferably in trunks, and it would be best to shake or brush them before using again. Remember that in almost three-fourths of recorded cases of snake bites the wound is in the lower extremities, leg or foot, and in only one-fourth, or most of remainder, is it in the upper extremities, especially the hand.

If a building in a rural district or other area becomes infested or there is the possibility that it may become infested, it is best to see that all windows and doors and areas under porches are screened, and especially those doors and windows in the basement or cellar. All holes in the foundation, floor, walls, window-sills, doors and fireplaces should be filled in with cement or any suitable filling material or even sealed tightly with board or metal. Where all other measures fail, a permanent concrete moat will exclude all snakes. Those working or walking in fields should never go barefooted.

ERADICATION OF SNAKES

It rarely happens that snakes infest thickly populated districts in such numbers that they become a nuisance. Where few are observed and their presence is not desired, clubbing or shooting is the most satisfactory method of getting rid of them. If they are present in large numbers in a building or home and the latter can be closed or sealed conveniently, then the best procedure for eradication is to employ hydrocyanic acid gas fumigation. Due to the deadly nature of this gas, this technique should be used only by one experienced in this method of fumigation.

If outlying districts of any inhabited community become infested with snakes and especially poisonous snakes, it is best to try and find the habitats of the latter, which are usually nearby, and here most of them can be found and killed.

Poisonous snakes are one of man's oldest and deadliest enemies. We have progressively exterminated or tamed wild beasts, insect pests, and other menaces to human life, but this native species of death-producing wild creature has been allowed to take its death toll without any concerted effort on our part to stop its propagation, obtain remedies specific to neutralize its poison or to take effective steps to stamp it out. Only recently has the warfare, assisted by modern scientific methods, gained momentum.

In rural districts and on the farm it would be best to familiarize oneself with the methods of differentiation between the poisonous and non-poisonous, valuable species of snakes and see that the measures employed in eradication are directed only against the former and not against the latter. Mice and rats, gophers, ground squirrels, moles, possums, and chipmunks, as well as young rabbits which interfere with the agriculturists by destroying their crops, are attacked by many snakes. Even on golf courses, where moles may disfigure greens, snakes are of value for the destruction of these pests. It is, therefore, advisable to see useful snakes should be allowed to proliferate in these environments and they should be given the opportunity to benefit man. Occasionally some species are found devastating poultry yards or fish ponds, so that measures are at times necessary for their destruction.

The offer of bounties as one of the methods of getting the layman interested in killing undesirable snakes in any environment may be tried, but this method of reducing their numbers is open to many objections. There is always present the danger that some people will import or obtain the desired snakes from distant or adjacent communities so as to receive the reward offered for each specimen. The introduction of the snake's natural enemies in an infested area is also dangerous unless one can be chosen which, when it will reduce the number of snakes, can itself then be gotten rid of, or if prevalent, it will not act as a nuisance. For there is always the possibility that this enemy of the snake may destroy other desirable animals or plants after it has exterminated the snake. Such, for instance, is the case with the mongoose. Yet there is a possibility that the European hedgehog or the skunk may prove to be the desirable natural enemy to employ. There is also a possibility that where poisonous snakes predominate in an area, harmless and inoffensive but cannibalistic species of snakes may be introduced to kill these undesirable invaders. The king snake and the musurana are typical examples. Yet, on the other hand, raising animals that feed on snakes always brings up other problems and is a method that usually does not succeed in practice, while the results of trying to get harmless snakes to feed on and replace poisonous snakes are not satisfactory.

Poisonous baits and traps are valueless in any program for the eradication of snakes. The complete obliteration of snakes in any large territory seems to be an almost impossible task, and accordingly we must be prepared at all times to treat bites by snakes so as to protect against the effects of their poisons.

WHAT TO DO WHEN BITTEN

When bitten by a snake, if possible, *kill or catch the snake that did the biting,* or if this is impossible, a careful or casual description of the snake may aid in the identification of the species. Knowledge of the fauna, and especially varieties of poisonous snakes apt to be present in any locality, is of great importance.

Just as it is necessary to capture a dog when bitten so as to find out if the animal has rabies, so one should attempt to find out whether the snake that did the biting is poisonous or non-poisonous. In the case of the snake, the identification is fortunately much easier than in the case of rabid animals. Such identification will enable one to avoid death or at least a considerable loss of time, discomfort, worry, money, etc. If the snake is a non-poisonous species, then no treatment is necessary, other than a local application of iodine or any similar disinfectant so as to prevent the slight wound from becoming infected.

If the snake that did the biting was a poisonous snake, then it might be necessary to identify the particular species. Just as in the treatment of gangrene we prepare and employ an antitoxin (antitoxic serum) which is specific for the neutralization of the toxin produced by the causative agent of gangrene and in tetanus or lockjaw, tetanus antitoxin is employed to neutralize the toxin produced by the tetanus bacillus (which causes lockjaw), so specific antivenins (antivenomic sera) are necessary in the treatment of bites by venomous snakes. In other words, antivenin for Cobra venom is useful for the treatment of bites of Cobra but not other snakes. The antiserum or antivenin is specific for the treatment of the venom from which it was prepared. The tendency today is to prepare a polyvalent antivenin (one made from the venoms of different species of snakes) which will counteract the effects of all venoms from poisonous reptiles. It seems impractical or impossible to prepare a polyvalent antivenin specific for venoms of all poisonous serpents found in the world, but a polyvalent antiserum or antivenin specific for most of the poisonous reptiles in a given locality is possible and is available. An antivenin to counteract the effects of all poisonous snakes in Brazil is available, being produced by the Brazilian government at the Seropathic Institute of Butantan, near the City of Sao Paulo, in the state of Sao Paulo, Brazil. Dr. Amaral, through the Antivenin Institute of America, with headquarters in Philadelphia, has produced polyvalent antivenin which is effective against the venoms of the principal poisonous serpents of the Crotalidæ. This includes the Rattlesnakes, Copperhead and Moccasin

(all pit vipers), the important poisonous snakes found in the nearctic region of North America, comprising Central Mexico, United States and Canada. Persons bitten by Coral Snakes found in the Southern States of our country and in Mexico would have to resort to other treatment. The so-called "Antivenin" (Nearctic Crotalidæ) or North American Anti-Snake-Bite Serum will not neutralize the venom of Coral Snakes. In other countries, antivenin specific for the venoms of the poisonous snakes in these localities must be employed.

If the snake is poisonous, there is also the possibility that the venom did not penetrate the circulation, or as in some instances there is the possibility that the poison glands are not functioning and venom cannot be secreted. In most cases, the presence of venom causes almost instant pain, swelling, discoloration, etc., and the chances are that if these symptoms are absent, the individual was bitten by a non-poisonous snake. As a precautionary measure where the biting occurred in this country in areas where pit vipers prevail, one can take an injection of North American Anti-Snake-Bite Serum. This will not cause any outward effects, even though venoms from pit vipers are not present in the system of the individual into whom the antivenin is injected.

Every naturalist, botanist, prospector, hunter, and sportsman, tourist, perpetual hiker and camper, surveyors, civil engineers and workers for public utility companies and those engaged in forestry and construction operations venturing into regions known to contain venomous pit vipers should carry along with them first-aid treatment for bites by these poisonous snakes. The drug store or if there are no drug stores in small communities, then the general store and all camps in localities where these snakes abound should have at all times first-aid kits. In the latter the following articles should be found: Two packages of North American Anti-Snake-Bite Serum (or the specific antivenin if in other countries), containing sterile syringe and sterile needle; several stout rubber bands or a rubber ligature; a sharp knife, scalpel or razor, a few sterile bandages and a package of sterile gauze; a small breast pump or other suction device, and tincture of iodine or other antiseptic. Dr. Dudley Jackson and Colonel Crimmins, in their campaign against poison snakes in Texas, have been using effectively the Dudley Kit which contains small rubber bulks, a unique suction type of apparatus. A first-aid outfit should be kept in a place where it can be obtained quickly, as promptness is essential in the beginning of the treatment.

(2) *Place a ligature or tourniquet,* preferably a rubber band, *above the bite (between the bite and the heart).* Don't lose time, but apply this promptly as soon as bitten, even if a strip of cloth torn from a garment has to be used instead of a rubber band, etc. By twisting a stick into the rubber band or ligature, the latter will be made tighter. The ligature should be released for a few seconds at five to ten-minute intervals to maintain necessary circulation and to prevent gangrene from setting in. This will prevent, or at least delay to a great extent, the systemic absorption of a deadly dose of venom from the amount present in the tissues immediately surrounding the wound. Above all KEEP YOUR HEAD, don't get despondent or excited, but ACT PROMPTLY AND SYSTEMATICALLY.

(3) If you are in reach of medical or scientific aid, call a doctor or a scientist who know how to treat snake-bite wounds. If they cannot be reached, then get the proper serum, and inject it yourself. If you do not have antivenin with you, arrangements should be made AT ONCE to procure some. Telegraph and use the aeroplane if necessary. *The early judicious use of the proper antiserum or antivenin is the best remedy available today in the treatment of snake bites.* If you have to give the injection yourself follow the directions as given on the label or circular. As the injection is about to be given, remove the ligature, or if the antivenin is administered within a few minutes after being bitten, a ligature or tourniquet is not needed, and in fact, should not be used, as it is necessary for the antivenin to circulate freely throughout the blood stream.

(4) Squeeze the wound to make the blood flow freely. This may carry away some of the poison. Incisions into and about the fang punctures so as to enlarge and make them deeper is still used by some, but most workers today claim that there is no particular advantage in doing this. Suction may be applied. It may prove to be of some value. Incision and suction are not necessary if antivenin is used early. In fact, if antivenin is available, incision is to be condemned, as there is a greater possibility of an infection setting in when the skin is cut.

(5) Don't pack the wound with crystals of potassium permanganate, and don't apply poultices or alum or parts of a snake's or other animal's body, or pour on the wound coal-oil or whiskey. Don't take alcohol or ammonia in any form internally.

Keep warm. Local treatment should be used by the Doctor, for it is of the greatest importance, as epsom salt or sodium citrate dress-

ings for inflammation, novocain injections to alleviate pain, etc. Coffee (or caffein) or the use of strychnine should also be avoided as this tends to raise the blood pressure, but there may be used if symptoms of weakness or giddiness develop or if the fangs may have struck an artery so that the venom was injected directly into the blood vessel.

(6) There is always a possibility that a wound made by the bite of a snake may become infected. It is, therefore, advisable to apply an antiseptic or an antiseptic dressing to the wound, even though the individual bitten survives the primary effect of snake poisoning.

The use of alcohol internally is to be condemned, as it is undoubtedly harmful. Alcohol stimulates heart action, thus helping absorption and it lowers the blood pressure which is just what is not desired. In addition to the delay of the absorption of the poison, it is desirable to maintain at all times a high blood pressure. There is many a story told about whiskey having saved the life of a human who was bitten by a snake, and in practically all of these so-called "cures" by alcohol the biting was performed by a harmless snake.

THE VENOM OR THE POISON

Poisons are produced by various venomous animals. Frogs and other Amphibians secrete a poison, which though not fatal to humans except in very large doses, nevertheless possesses irritating properties. Most Amphibians as frogs, toads, etc., derive their protection by pouring out this poison on the skin. Certain fish and other creatures are fitted with projecting bones or spiny fin-rays with which to introduce their poison. Various spiders and scorpions are capable of causing considerable trouble by their stings or bites due to the poison which is injected. In fact, in some tropical and semi-tropical areas, the latter are a real menace and attempts are under way to prepare specific antivenins to combat scorpionism (scorpion poison) and arachnidism (spider poison). You are all familiar with the fact that the savage races have used at various times the poisonous products from snakes, lizards, fishes, toads, and the juices from ants, bees, beetles, centipedes, spiders and wasps for their poison arrows.

SNAKE VENOM OR SNAKE POISON

Snake venom is a secretion derived from the supralabial gland. The latter is a more or less developed gland present on each side of the head beyond the eye above the lip margin and resembles in its development the parotid salivary gland in mammals. The amount of venom secreted varies with each species and generally speaking is in propor-

tion to the size and age of the snake, the length of the period of hibernation, fasting, repose, etc., and other environmental factors. Larger and older specimens secrete larger amounts of venom. The venom from the different groups of poisonous snakes vary in their toxicity as well as in their therapeutic action. The amount of poison injected (in relation to the size of the animal) and the degree of its virulence (which varies not only in the different kinds of snakes, but in the same snake under different conditions) governs the seriousness of the symptoms or whether death will result. In examining a wound made by a poisonous snake, the distance between the two punctures made by the fangs frequently bears a relationship to the amount of venom injected. If the fang-puncture points are far apart, it is more than likely that a large snake and one capable of throwing forth a large amount of venom caused the bite. And it is well to point out again that as important as is the toxicity of the venom and the amount secreted is the ability of the inoculating apparatus (the fangs) of the snake to inject or introduce the venom into the deeper tissues of the animal bitten.

The venoms or poisons are viscous, yellowish liquids, clear or very slightly clouded; and containing in solution as they do an amount of protein equivalent to from one-quarter to one-third or more of their weight, they are grouped with the proteins. The remaining substances present are water, carbohydrates, small amounts of inorganic salts and occasional admixtures of abraded epithelial cells or other cellular material. Venom may contain different ferments or enzymes and one or more of several toxic elements which vary in their activity and action. Some of the ferments which may be found are: Proteases (proteolytic ferment), which may produce softening of muscle tissue; lipases (lipolytic ferment), which possesses a feeble action in the splitting of lecithin and in the fatty degeneration of the liver; a diastatic ferment, which may activate the inactive pancreatic juice so that the latter will attack albuminoids; and a fibrin ferment, which attacks fibrin, the coagulating element, resulting in a loss or reduction of capacity of the blood for coagulation.

The snake venoms contain one or more of several toxic elements which may attack red blood cells (classified as hemotoxins and hemaglutinins), nerve cells (neurotoxins), white blood cells or leukocytes (leukotoxins) and endothelium (classified as endotheliotoxin, endotheliolysin or hemorrhagin). The hemorrhagin is especially marked in the Rattlesnakes constituting the chief toxic element in the venoms

of these pit vipers. The endothelial lining of the blood vessels, and in particular that of the capillaries, are destroyed and there soon appears hemorrhagic (bloody) infiltration and an enormous swelling around the wound. The venoms that are neurotoxic cause death by paralysis of cardiac and respiratory centers. Neurotoxins are present in but relatively small amounts in the venoms of the pit vipers but predominate, being present in great amounts and are the chief agents causing death in the venoms of the genus Micrurus containing the Coral Snakes as well as in the other Elapine Snakes, including the Cobras and their allies. The only important exception worth while mentioning is in the case of the South American Rattlesnake, which unlike other species of Rattlesnakes contains a strongly neurotoxic poison which has a selective action for the optic nerve, producing blindness almost immediately.

The action of most venoms in human beings is observed by a local reaction almost immediately after being bitten. These symptoms are usually severe and painful. The only important exception is in the case of bites by the Kraits found in the Old World, where in most cases local reactions do not occur. The poison or venom after being introduced into the deeper (subcutaneous) tissues, reaches finally the general circulation by absorption through the lymph and blood vessels. Snake venom is absorbed by the conjunctiva and is not absorbed in the mouth or alimentary canal unless abrasions and cavities in teeth are present. The gastric juice destroys most all venoms except that secreted by the Cobra, the Old World Vipers, and the Black Snake of Australia (Pseudechis porphyriacus).

The rays of the spectrum, as well as rays from radium and electricity, reduce and finally destroy the toxic power of snake venom. Varying degrees of heat, differing somewhat for the venoms from the several groups of poisonous snakes, as well as certain chemicals, will detoxify venom in vitro (that is, in a test tube). When snake venom is dried without heat, small amber-like crystals of material are obtained. Venom thus dried or dessicated retains the original toxic qualities of the liquid in unaltered strength for long periods of time.

IMMUNITY AGAINST SNAKE VENOM

Poisonous snakes are immune against their own venom, so that if poisonous snakes of the same species bite each other and if a snake injures itself as it may at times, any venom which may be injected will have no effect. The "mussarana" in Brazil, known also as the "zumbadora," and the king snake in this country are immune to

the venom of poisonous snakes. The armadillo, peccary, skunk and hedgehog are other important natural enemies which are immune. In the case of the hog, it is questioned whether there exists a natural immunity as it is believed that the venom rarely enters the deeper vascular tissues due to the thickness of the skin. The mongoose, which was made famous as an eater of poisonous snakes, has been said to be immune to the venom of poisonous snakes, but this is an error, as this mammal is not immune.

SPITTING SNAKES

Some snakes are capable of discharging the venom without actually biting. They shoot or direct their poison from their mouths in a fine spray or jet often to a considerable distance. Such snakes are known as "spitting snakes." The venom is not irritating to the skin (unless the latter is abrased or cut), but if it penetrates the eye, at which the snake seems to aim deliberately, there is a rapid absorption, sharp and intense pain, and even a temporary blindness. If treatment is applied immediately, the inflammation of the conjunctiva subsides in a few days. The important spitting snakes are found mainly in Africa, although the Indian Cobras, Russell's Viper and even some species of Rattlesnakes have been known to make use of the ejection of a spray of venom at certain occasions.

The Ringhals (Sepedon hæmachates), a South African Cobra, is quick and vicious and is capable of ejecting fine jets of poison for a distance of 6 to 8 feet, usually aimed with a fair degree of accuracy at the aggressor or observer. One is therefore apt to receive the dangerous poisonous spray in the eyes if these were not protected with glasses or goggles. The latter are generally employed when handling these snakes in captivity.

INTERNAL AND OTHER REMEDIES FOR SNAKE-BITES

Max Neuberger, in his "Geschichte der Medizin," mentions that Greek and Roman writers have handed down a number of fables according to which we owe many therapeutic means and measures to animals, and he states that tortoises were used as an antidote for certain kinds of snake bites. He also mentions that in India the bitter root of Ophiorrhiza mungo was and is used as an antidote for snake bites. Guaco or huaco, known also as herba de Cobra or Yerba capitana, being Mikania guaco, is probably the best known alleged antidote for snake poisoning. This is valueless both in the treatment of snake

bites or as a prophylactic. Simaba cedron, another plant, the nuts of which have been and are used as well as a host of other plants and drugs are also valueless. Snake stones which are calcareous concretions extracted from the bladders of various animals are used in India and other Oriental countries, but they, too, do not possess real curative value. May I repeat again that most all remedies other than mentioned are valueless or even harmful and are to be condemned. The most reliable treatment is an injection as soon as possible of an adequate amount of ANTIVENIN which had been prepared from the venom of the same species of snake, which did the biting. In this country, North American Anti-Snake-Bite Serum will answer in all cases except when bitten by Coral Snakes. Then don't forget the immediate application of a tourniquet until the injection is given and the other measures mentioned may follow.

ANTIVENIN

You have observed when considering snake venom that certain agents will detoxify the latter when both are mixed together in a test tube or in any other container. But such agents cannot be employed in our bodies during life (in vivo) as the venom is so quickly absorbed that it would be beyond reach of these chemicals. In other instances, the latter cannot be used as they would exert an injurious effect upon our tissues and body cells. Aspiration, or suction, though practical, and this should be used when possible, does not always yield effective results as the undesirable element in the venom fixes itself frequently to certain tissue cells and cannot be extracted by these mechanical agents and methods. Attempts have, therefore, been made to find some remedy which could be injected into the body and which would neutralize the toxic elements of the venom before the latter would be fixed to tissue cells and destroy the latter and finally cause death. This resulted in the production of Antivenin.

In the case of an injury with a rusty nail or other implement suspected of containing the organism causing tetanus or lockjaw, we advise an immediate injection of Tetanus Antitoxin. The latter will neutralize any toxin or poison produced or secreted by the tetanus organism before this toxin combines with the nerve cells. In like manner in the case of a snake bite, the average human being does not usually know whether the snake which did the biting was poisonous, or if poisonous, whether any venom penetrated the deeper layers of the skin, or if venom was deposited, whether a lethal (poisonous)

dose of venom did penetrate. Generally speaking, we may say as mentioned, that the appearance immediately of local symptoms and pain are indicative of the presence of venom. But if these do not appear, and one is not sure that the attack was by a non-poisonous snake, then in addition to any non-specific measures as application of tourniquet, suction, etc., specific antivenin should be administered as quickly as possible so as to neutralize any and all of the absorbed venom.

The introduction of antivenin, a serum preparation to combat venom, by scientists, resulted in another great boon for mankind and a decided forward step in the fight of man against the bites by poisonous snakes. The preparation and practical use of antivenin prepared especially for the India Cobras, etc., was attempted about thirty-five years ago by Dr. Albert Calmette of the Pasteur Institute in France. It was soon found that the serum or antivenin was specific only for the neutralization of the venom which was employed for its production. Nevertheless, in spite of this, the specific antivenin was employed in bites by any kind of snakes, with favorable results of course prevailing only there where the specific venom was present. In the Western Hemisphere experimental lots of antivenin were prepared and used by the Rockefeller Foundation and Dr. R. L. Ditmars in this country. In 1899, the Seropathic Institute of Butantan was established by the Brazilian government. Some twenty-seven years later, the Antivenin Institute of America was formed and workers here under Dr. Amaral began to experiment with the venoms of North American Snakes. Twenty-three months ago a license was issued by the U. S. Government authorizing the sale and manufacture of antivenin in this country.

The tendency has always been to prepare an antivenin specific for venoms of all poisonous serpents found the world over, but it has been found impossible or impractical to prepare such an antiserum or antivenin. An antiserum or antivenin specific for all poisonous reptiles in a given locality is possible and is available today. The antivenin prepared by the Seropathic Institute at Butantan will counteract the effects of all poisonous snakes in Brazil. The North American Anti-Snake-Bite Serum or Antivenin (Nearctic Crotalidæ) is effective against the venoms of the principal poisonous serpents of the Crotalidæ. This includes the Rattlesnakes, Copperhead and Moccasin, the important poisonous snakes found in the nearctic region of North America, which includes Central and Northern Mexico, United States and Canada.

In other countries, as in India, there are available Colubrine Antivenin and Viperine Antivenin, wherein the former will be of value for the treatment of all Colubrine venoms and the latter will be specific for all Viperine venoms. The early judicious use of these specific antisera or antivenins is the best remedy available to-day in the treatment of snake bites.

PREPARATION OF ANTIVENIN

The process of making Anti-Snake-Bite Serum or Antivenin is in general in the same way as is the making of diphtheria or tetanus antitoxin. In the case of the latter, the soluble toxin or poison from the diphtheria or tetanus bacillus is obtained while when making the antivenin the venom or soluble poison from the poisonous snakes is employed as the starting point. Injections of these poisons into animals (usually horses) incite the latter to produce antibodies or protective substances specific for the toxin or venom injected and (the serum from such animals are known as an Antitoxin or an Antivenin, respectively).

The initial step, therefore, in the production of antivenin is to obtain the desired venom. Live poisonous snakes must be available to supply the latter. In many instances, the venom is removed from the live snakes kept in the several zoological parks throughout the country. Wherever possible live poisonous snakes are kept at the immunization laboratory. In countries where zoological parks are not numerous or only few of a given variety of poisonous snakes are in captivity, or they are difficult to keep in captivity, arrangements are made to collect as many of the different varieties and keep them under more ideal natural conditions so that their young may be collected, and also under these conditions better arrangements may be available for the study of the habits and other characteristics of poisonous snakes. Such a snake farm is known as a serpentarium. A large serpentarium operated by the Seropathic Institute of Butantan is to be found in Brazil where the snakes live in stone houses resembling Eskimo igloos. Fences and narrow moats filled with water prevent the snakes from escaping. In the serpentarium near Tela, Honduras, operated under the joint cooperation of the United Fruit Co., the Harvard Museum of Comparative Zoology and the Antivenin Institute of America, many small celotex huts are available under roofs of manaca palm trees. Here are to be found the different varieties of poisonous snakes commonly found in these countries. The construction of snake farms or serpentariums where snakes are

bred is perhaps cheaper than could be possible by resorting to methods of obtaining the specific species in the wilds or in their respective habitats. For use in commerce, serpentariums have not as yet been developed. This is impractical or unwarranted or too expensive when compared with the present procedure of obtaining the skins. Then again not knowing how long the snake hide fad will last, it is perhaps inadvisable to resort to breeding, when in the jungle and forest regions of Asia and Africa they are so numerous and labor for obtaining them is comparatively so cheap.

Arrangements are then made to remove the venoms from these poisonous snakes at designated intervals, usually every two or three weeks. The snake is caught, snared or lassooed either by the use of a forked stick, a noose or hook stick, and its head is pressed down to the ground. It is then grasped behind the head and around the neck with the operator's left hand, the reptile's body being held under the arm, or if it is a large snake between the thighs and some other support, or the tail is held by an assistant. Various techniques are then employed for obtaining or extracting the venom. In this process of extraction the snake is made to imitate its natural "strike." This is accomplished by forcing its fangs against a shallow glass cup, or by means of forceps the snake's mouth is opened and the reptile is induced to bite through a diaphragm of parchment or rubber sheeting stretched over a glass cup. The glands around the sides of the head are then massaged gently to force out all of the venom. This process is at times spoken of as milking. The fluid which is expelled in the receptacle in an amount of from 2 to 30 drops, averaging 10 drops from each snake, the quantity varying depending upon the size and other characteristics of each snake, appears as a thin viscous fluid about the consistency but more yellowish than the white of an egg. If any blood cells or other cellular matter is present these are removed by whirling the venom about in a centrifuge. The cellular matter deposits and the absolutely pure venom is thus obtained by drawing off the clear supernatant liquid. This may be mixed with an equal quantity of glycerin and kept in the ice box or shipped, but a still better method is to directly dry the material. The venoms from the same species of snakes can of course be mixed together. In drying, the venom is placed in shallow dishes, properly covered, and these dishes are placed in an incubator at body temperature for at least 48 hours. Small amber-like, brittle scales are the result and these may be kept indefinitely and shipped far and wide. This venom in its natural state, unaltered but dried, is employed as the

starting point in the making of antivenin. The first step of the collection of the venom and its drying does not necessarily have to be conducted at the immunization laboratory. Venom can be collected and dried in any part of the world and shipped to the laboratory where the horses are to be immunized for the production of the antivenin.

The next step is to proceed with the process of immunizing the horses. The dried venom is redissolved and an extremely small amount is injected into the horses as the first dose. The dosage is very gradually increased at each subsequent injection that is given, generally from every three to five days. The dosage of venom may be accurately graduated, for it is possible by various technical operations to determine the strength and thus standardize the venom.

At various intervals during the process of immunization, trial bleedings are made to determine the progress in the development of antivenin, the latter being antibodies specific for venom. When the peak of antivenin content is reached, additional injections of venom will not increase the antivenin content. It is, therefore, necessary to make these trial bleedings to find out when the peak has been reached, for it is then that the horse is ready to be bled. This period of immunization may take six months or more. The last dose of venom is an amount almost 1000 times as large as the initial one and still the horse is able to tolerate it, due to the large amount of venom antibodies or antivenin present in its blood.

When the horse is ready to be bled, from one to three gallons of blood are withdrawn from the jugular vein. The serum is separated from the corpuscles and other elements and by a series of technical processes as is practised in making diphtheria antitoxin, the antivenin is purified and concentrated. This reduces the bulk of the finished antivenin and rids it of almost all of the valueless, and in fact, harmful horse-serum protein. After a fairly dependable method of standardization and the performing of several tests to insure that the marketable preparation is sterile, the antivenin is placed in suitable containers or syringes ready for its life-saving work.

Antivenin is best preserved at ice box temperature, but even at a moderate temperature it will keep its strength for many years. Antivenin manufactured in this country is effective against the bites of the Copperhead, Moccasin and Rattlesnakes. It is supplied in syringes containing approximately one-third of a fluid ounce of material. If medical aid is available, the injection is given directly into the muscles (intramuscularly) or into the veins (intravenously),

CASES OF SNAKE BITES REPORTED DURING 1928 IN UNITED STATES

(AS REPORTED TO THE ANTIVENIN INSTITUTE OF AMERICA)

North Atlantic and Central States:													Total
Vermont				1									1
Connecticut				3									3
New York	5		1									1	7
Pennsylvania	26			7								8	41
New Jersey	3											4	7
Delaware	1												1
Maryland	7											1	8
Ohio	9			1									10
Michigan		2a	1	2								1	6
Illinois	2	1											3
Minnesota					1							1b	2
Iowa					1								1
Wisconsin												1	1
Southeastern and Gulf States:													
Virginia	17			3								4	24
West Virginia	14											1	15
Kentucky	2										1c		3
North Carolina	9	1		7							4	2	23
South Carolina	5			4			1				1		11
Georgia	3	4		3		1	2				9	9	31
Florida		7		7		1	8				2	3	28
Alabama	11	12		1		4					16	3	47
Mississippi	1	3		2		3	1					7d	17
Missouri	6	1										1e	8
Arkansas	5	1		3		1					4	3	17
Louisiana		6									3	5d	14
Tennessee	4			2		1						1	8

Western and Southwestern States:												
Montana				7								7
North Dakota										1b		1
South Dakota				5								5
Wyoming				3						1		4
Nebraska				5								5
Colorado				10								10
Kansas	1			5						1		7
Oklahoma	3							2				5
Texas	33	5	2	1	1			89	14	16		161
New Mexico				1				4	7	2		14
Pacific Coast and Rocky Mountain States:												
Arizona							3	1	7			11
California								1	5			30
Oregon						24	1					1
Washington						1						1
Nevada						1	1					2
	Copperhead	Cotton-Mouth Moccasin	Massasauga	Crotalus horridus	C. confluentus	Ground or Pigmy Rattler	C. adamanteus	C. oreganus	C. cerastes	C. atrox	Rattler Species	Undetermined Species	

A—in capitivity.
B—C. atrox in captivity.
C—in carnival collection, probably C. atrox.
D—one Coral Snake.
E—non-poisonous.
F—with circus, probably C. atrox.

so as to hasten the introduction of the venom antibodies. If a physician is not available, then antivenin can be administered by anyone familiar with its use, or it can be self-administered if necessary in the same manner as a patient having diabetes injects insulin beneath the layers of the skin (subcutaneously). Children require larger amounts of antivenin than would be the case in an adult bitten by the same poisonous snake. Where considerable time has elapsed before the injection of the antivenin, or if there is reason to believe that a large amount of venom was deposited when bitten, more than one syringe of the antivenin should be injected. At all times, if there is no improvement within four to five hours after an injection, a second dose of antivenin should be administered and a third or even fourth dose may be indicated if at six-hour intervals no improvement is apparent.

If a tourniquet had been applied, it should be removed immediately as soon as the antivenin is injected; or if when bitten antivenin is at hand to be injected immediately, then a tourniquet should not be applied. The miraculous effect obtained by the use of antivenin, not only in the fact that there is a swift recovery, but especially that there is a clear recovery without any local symptoms or discolorations, is only appreciated by those familiar with the after-effects of a snake-bite poisoning. Antivenin has accomplished and is accomplishing in snake-bite poisoning what diphtheria antitoxin has accomplished in the treatment of diphtheria.

LAWS ENACTED FOR PROTECTION AGAINST OPHIDISM

It is interesting to note that thirty-four months ago the Costa Rican Congress passed a law which forbids the sales of remedies against snake bites unless they are specifics to be employed in scientific methods of treatment of snake bites. They also require the health authorities to publish data relating to Ophidism and its treatment and a supply of specific Antivenin and first-aid outfits are to be kept in all public dispensaries, railroad stations, and in Government or other public buildings, so as to be easily accessible. This law is indeed a forward step along the proper lines and a similar enactment should be passed by the governments of other countries which have to contend with poisonous snakes, and especially where bites by the latter may interfere with the health of their people or even appear as an economic factor.

SUMMARY OF ALL REPORTED CASES IN U. S. A. DURING 1928

	No. of Cases	Death	Death Rate
Antivenin	427	13	3.3%
No Antivenin	174	17	10.2%
Total	601	30	

In the first table, you will observe the distribution of the poisonous snakes in this country. In the second table, you will observe the high death-rate in snake-bite poisoning, where Antivenin was not used. The 3.3 per cent. death-rate where Antivenin was used would have been markedly reduced, if in those cases the Antivenin was used immediately or at least as soon as possible after being bitten, and in few instances if a larger amount of the Antivenin was used, necessitating two or more injections. These two tables, as well as the illustrations, were obtained through the kind courtesy of the Antivenin Institute of America.

THE UNITED STATES TRADE IN GUMS, RESINS, AND BALSAMS

By F. A. Delagado,

Chemical Division Bureau of Foreign and Domestic Commerce, Washington, D. C.

THE UNITED STATES is one of the largest world consumers of gums, resins, and balsams. In 1926 it imported $34,045,000 worth, and in 1927 $32,536,000 worth. These various gums originate in nearly every section of the world.

Over 60 per cent. of the United States import of gums and resins is used in the manufacture of paints and varnishes. Statistics show that the United States produces approximately 60 per cent. of the world's output of these products. (See The American Paint and Varnish Industry in Relation to Exports, *Commerce Reports,* February 13 and April 23, 1928.) In addition, the textile industry requires certain gums, such as tragacanth, for sizing textiles, thickening mordants, and other uses; the drug industry employs gums, resins, and balsams in various official and nonofficial medicinal and toilet

preparations; and these materials are also used in the manufacture of dental cements, mucilage, pyroxylin plastics, and confectionery, for gumming stamps and envelopes, and as incense.

Crude Camphor From China and Japan; Synthetic From Germany

Imports of camphor into the United States represented 10 per cent. in 1926 and 9 per cent. in 1927 of the total imports under the classification of gums, resins, and balsams. China and Japan are the sources of nearly all of the natural crude and refined, whereas Germany supplies practically all of the synthetic.

Camphor is used chiefly in the manufacture of pyroxylin plastics and allied products, such as photograph films; but is also employed in pharmacy and medicine, and achieved an extraordinary consumption during the influenza epidemics.

Commercial camphor is chiefly produced by the Japanese in Formosa and Japan. The annual export of Japanese camphor in recent years is estimated at between 5,000,000 and 7,000,000 pounds, of which about five-sixths is from Formosa. Camphor is also commercially produced in China, but wasteful methods have diminished its supply. The camphor tree has been introduced into India, Java, southern Europe, and also in Florida, but without important commercial results. Refining is carried on in the United States chiefly by the manufacturers of pyroxylin plastics, the principal consumers. Camphor oil, a by-product of refining, is important in the production of heliotropine and other synthetic chemicals. Synthetic camphor has been rather extensively manufactured in Germany, and about 1907 was also produced in the United States, but the fall of camphor prices eliminated the domestic industry.

Chicle an Increasingly Important Item

Imports of chicle into the United States represented 12 per cent. in 1926 and 13 per cent. in 1927 of the total imports of gums, resins, and balsams. This gum is of special interest to the manufacturer of proprietary medicines owing to the comparatively recent introduction of medicated laxative gums. Crude chicle as it leaves Mexico contains about 50 per cent. water, some of which is lost in transportation, and, as imported, about 40 per cent. water. Its chief use is in the manufacture of chewing gum, for which it is refined by grinding, straining, and drying.

Crude Balsams Largely From Brazil, Colombia, and Salvador

The value of the 1926 and 1927 receipts of balsams was less than 1 per cent. of the total imports of gums, resins, and varnishes; nevertheless, they are of great interest and importance. Balsams are used in medicines, pharmacy, perfumery, cosmetics, microscopy, and the arts, and occasionally for technical purposes.

Imports of crude balsams into the United States were 25 per cent. greater in the first four months of 1928 than in the similar period of 1927—133,000 pounds, valued at $131,000, as compared with 92,063 pounds, valued at $68,000. For the six-year period, 1922 to 1927, inclusive, Brazil has been the source of 40 to 55 per cent. of the United States imports of crude balsams, followed by Colombia with 16 to 25 per cent. and Salvador with 10 to 20 per cent. Honduras, Nicaragua, the United Kingdom, Germany, Turkey, Greece, Italy, Canada, and the British West Indies supply small amounts.

Imports in pounds and dollars for the six-year period 1922 to 1927, inclusive, were as follows:

Imports of Crude Balsams Into the United States

Year	Pounds	Value	Year	Pounds	Value
1922.....	490,000	$199,000	1925.....	500,000	$262,000
1923.....	368,000	193,000	1926.....	325,000	181,000
1924.....	300,000	203,000	1927.....	413,000	204,000

The principal balsams imported into the United States are copaiba and Canadian fir. Both are liquid oleoresins and not true balsams, chemically speaking.

The principal use for copaiba is in medicine and in the manufacture of varnish, lacquer, and tracing paper. It is obtained by the natives of Brazil, and, to a less extent, Venezuela, Colombia, and Guiana, from wild trees.

Fir or Canada balsam is chiefly used in microscopy, and, to some extent, in medicinal preparations, such as plasters. Mixed with oil of turpentine, it is used in making tracing paper. The tree yielding Canada balsam occurs through Canada and northeastern United States along the Appalachian Range, and is chiefly valued as a source of cheap lumber and paper pulp. The balsam is principally collected for commerce by the Indians of Quebec and is not sufficiently remunerative to attract other labor. Smaller quantities are assembled by Indians in Maine.

Balsams and Gums Used as Perfume Materials

Perfume materials embrace various animal and vegetable products and aromatic chemicals made from essential oils, as well as solid substances in the form of balsams, resins, and oleoresins, which are free from essential oils. Balsams and resinoids are important and the resins of orris, patchouly, sandalwood, and vetiver are of exceptional merit. The odors are rich, full, and, in addition, have a high degree of fixation. Well-known resinoids include benzoin Siam, labdanum, myrrh, oak moss, olibanum, opopanax, orris, patchouly, Peru, sandalwood, storax (American) tolu and vetiver. Among the more important materials are the following:

Frankincense, a fragrant gum resin, also known as olibanum resin, which from time immemorial has been regarded as one of the indispensable ingredients of incense for ceremonial purposes.

Labdanum, or labdanum resin, a product of the very highest importance in the manufacture of heavy perfumes, and often described as having a somewhat "languorous" oriental odor.

Storax, a true balsam, used principally for flavoring tobacco, but also employed in medicine and the perfumery and cosmetics industries.

Storax is obtained from Asia Minor. It is valued in oriental medicines and chiefly consumed in India and China. Tropical America also produces large amounts, which have appeared on the American market, particularly at the commencement of the World War, when there was a great scarcity of oriental products. The oriental storax then available, moreover, frequently was deprived of its aromatic constituents.

Balsam of Peru, also a true balsam, used in medicines and perfumery and to some extent as a cheap substitute for vanilla.

Peru balsam is a very useful substance in the preparation of heavy odors of the oriental type and is also possessed of good fixative properties. It is employed in the form of an alcoholic solution. The United States is said to take normally about half of the annual production of the Republic of Salvador, its sole supplier. The other half goes chiefly to Germany, where an artificial Peru balsam is also produced.

Balsam of Peru is adulterated to a considerable extent, principally with an artificial balsam made up to closely imitate the natural product. The methods of preparation of the pure balsam in San Salvador are very variable, so that pure samples have characteristics which vary

within somewhat wide limits. Common American rosin is sometimes used as an adulterant, but this is fairly easy to detect.

Balsam of Tolu, a true balsam, used in medicine and pharmacy, and in the manufacture of perfumery, cosmetics, and chewing gum.

Balsam of Tolu is a forest-tree product collected chiefly in Colombia and in smaller quantities in Venezuela and Peru. It has excellent properties as a fixer and is also valued for its sweet and persistent odor. As in the case of balsam of Peru, it is often adulterated.

Benzoin, or gum benjamin, as it is frequently called, a balsamic resinous matter obtained from various species of the styrax tree, of which styrax benzoin is the most important.

The trees which yield benzoin are found principally in Siam, Sumatra, and Java. This, like several other important perfume resins, may be described as a pathological secretion.

Opoponax, a resinous body resembling true opoponax in color and appearance, and in odor suggestive of a slightly perfumed bdellium—often described as "perfumed bdellium."

Egypt a Large Supplier of Gum Arabic

From the most remote records of antiquity gum arabic or acacia has been an article of commerce. It forms large forests in eastern Africa, Khorodofon, and southern Nubia. There are two principal commercial varieties: (1) The Khorodofon or Arabian gum and (2) the Senegal or West African gum. Cairo and London are the chief markets of the world's supply. Senegal or West African gum ranks second to the Khorodofon and is derived from species of acacia growing in the Sudan and Senegal. It yields a good adhesive mucilage and is valuable for technical purposes. The better grades have certain pharmaceutical uses and are also employed for sizing fabrics, in calico printing, and in the manufacture of water paints, calcimines, mucilage, matches, and confectionery. India gum or Persian gum, which is said to be sent from Persia to Assuan to be packed as genuine gum arabic, can be detected, since it does not dissolve in water. A somewhat similar mucilage is derived from Irish moss.

From one-half to two-thirds of all the acacia imported into the United States comes direct from Egypt. The balance is obtained principally from London. In 1926 and 1927 imports of gum arabic into the United States represented 3 and 2 per cent., respectively, of the total receipts of gums, resins, and balsams.

Gum Tragacanth Imported Through London

Tragacanth, one of the oldest drugs in the Materia Medica and a demulcent, is the basis of many troches, but is used chiefly for sizing textiles. It is very abundant in the mountains of Asia Minor and is brought from the interior to Smyrna. This gum represented over 2 per cent. of the total United States 1926 and 1927 imports of gums, resins, and balsams. The value of the 1927 imports incidentally represents the highest figure for the last six years. Persia, Turkey, Iraq, and British India are the principal sources. The commercial supplies of tragacanth used in the United States are imported chiefly from London.

Other Gums and Resins

Gums and resins not enumerated in the preceding paragraphs and imported into the United States during 1926 and 1927 were valued at $1,615,000 and $1,446,000, respectively. These amounts represented over 4 per cent. of the total imports under consideration, and originated in approximately forty different countries, but largely in the United Kingdom, British India, France, Colombia, and Egypt. Included in this classification are:

Mastic, a resinous exudation obtained from a tree native to the countries bordering upon the Mediterranean; formerly thought to possess properties analogous to those of the turpentines and prescribed for debility of the stomach. In the East an aqueous infusion is said to be still used in cholera infantum. Dissolved in alcohol or oil of turpentine, it forms a brilliant varnish.

The mastic imported into the United States and Great Britain is obtained only from the island of Scio, or Chios, in the Grecian Archipelago, where the tree is cultivated for this product.

Asafetida, a gum resin and crude drug, obtained from the root of a wild plant native to the deserts of Persia and Afghanistan, and imported largely from India. It is an ancient medicinal, not now highly valued, but still used in nervous affections. For the six-year period, 1918 to 1923, imports of asafetida averaged 80,000 pounds, but fluctuated in value from $0.25 to $2 a pound.

Aloes, the dried juice of a tropical plant commonly classed as a gum, used as a cathartic and as an ingredient of many proprietary pills. It comes in several varieties from Curacao, Netherland West Indies, and Africa.

Gamboge, a gum resin which acts as a powerful, drastic, hydrogague cathartic and is almost always used in combination with other cathartics. It is found largely in Indo-China, India, and Siam, but the United States imports come mainly from Singapore, Straits Settlements.

Amber, a fossil resin occurring in small lumps, and found principally in East Prussia. It is picked up along the shore of the Baltic, and is obtained by mining. It varies in color from pale yellow to red, brown, or even black, and may be transparent, translucent, or opaque. The United States produces no amber, although small but not commercial quantities of fossil gum resembling amber appear in Maryland and New Jersey.

Amberoid is produced by heating and forcing small bits of amber into a solid cake, by hydraulic pressure, with or without other substances such as copal and camphor.

Amber is now being replaced for ornamental articles by artificial products resembling amber in appearance and properties, but differing greatly in chemical nature. These so-called "synthetic phenolic resins" are made by the chemical combination of phenol with formaldehyde or hexamethylenetetramine.

Artificial resins have long been used in the paper and textile industry as substitutes for natural products, but it is said that in comparatively recent years only have dextrine and artificial gum been entertained as mediums to hold in suspension perfume materials added to scent the finished product. They also have possibilities as fillers for soap creams, grease creams, lotions, and similar products.

Dragon's blood, a red, resinous substance exuded from the ripe fruit of several species of small palms growing in Siam, the Molucca Islands, and the East Indies. It is collected by the natives and marketed either in the form of small oval drops or in long cylindrical sticks. While its principal employment is in coloring varnishes, it is also used in pharmacy.

Imports of dragon's blood have ranged from a minimum of 12,034 pounds in 1911 to a maximum of 58,000 pounds in 1923.

Sandarac, a resin obtained from a small evergreen tree which is indigenous to northwestern Africa. It is also obtained in Australia from a similar tree and is known as white pine resin. Sandarac is used chiefly as a varnish resin and to some extent in dental cements and as incense. In 1926, 190,000 pounds, valued at $48,000, were imported into the United States.

Kadaya, a gum, of which 1,987,000 pounds, valued at $210,000,000, were imported by the United States in 1926.

Tragasol, a gum, of which 6,853,000 pounds, valued at $633,000, were received in 1926.

Guaiac, a resin from wood, found in all countries where the lignum-vitæ tree grows; like many other resinous substances a stimulant and alterative. Guaiac resin is chiefly produced in the eastern portion of the island of Haiti and is exported from Azua and Gonaives in bags within cases.

Scammony resin, a mixture of resins obtained from scammony or Orizaba jalap root.

Ipomea resin, an energetic cathartic, sometimes operating with harshness.

Other gums, including talka, myrrh, gambier, euphorbium, galbanum, gambogue, ghatti or Indian gum, Indian kina or malabar kina, gum accroides, angica, anime, bush, carana, cebil cedar, elemi gedda, kuteera, mango, mesquite plant, sassa, savokin, sonora, sterculia, and turie.

MEDICAL AND PHARMACEUTICAL NOTES

A New Sensitive Color Reaction of Copper*—Certain oxidising agents, when added to very dilute feebly alkaline solutions of a cupric salt containing dimethylglyoxime, produce an intense reddish-violet color resembling that of permanganate. That produced by sodium hypochlorite or bromine water is rather fugitive, partly due to the sensitiveness of the color to acid and excess alkali, and to the difficulties of adjusting the pH value when using these oxidants. Ammonium persulphate produces a weak reddish color, but on addition of a trace of silver nitrate, an immediate development of the intense permanganate color occurs, especially when pyridine is used as the means of obtaining slight alkalinity. As a result of many experiments carried out to determine the concentration of reagents most favourable for the reaction, the following is proposed as a method for the detection and determination of traces of copper in solution:

*Communication from the Research Department, Woolwich.

The solution, which must be free from chloride, is neutralised and rendered very faintly acid (1 drop of dilute (1:3) sulphuric acid in excess). It is placed in a 100 cc. Nessler glass, made up to volume, and 1 grm. of ammonium persulphate is dissolved in the solution; 1 cc. of saturated alcoholic dimethylglyoxime, 0.5 cc. of a 0.5 per cent. solution of silver nitrate, and 2 cc. of 10 per cent. aqueous pyridine are added, and the whole is stirred. The color may be compared colorimetrically by running a standard solution of copper sulphate (1 cc. = 0.00001 gm. of Cu) into 100 cc. of a solution containing the same amounts of reagents. The comparison should be carried out without undue delay, as the color shows some tendency to fade on standing. Where slight opalescence, due to traces of chloride (impurity in the reagents) appears, it is permissible to discharge it by adding a little more than the specified amount of pyridine. As little as 0.01 mgm. of copper yields a distinct reddish-violet colour, the method is not suitable for determining more than 0.1 mgm. One part of copper can be readily detected in 10,000,000 parts of water. Comparative tests at 100 cc. volume with the xanthate and ferrocyanide methods have shown that this reaction is somewhat more sensitive than the former, and from five to ten times as sensitive as the latter. Small amounts of certain other heavy metals give yellowish or brown colorations under the conditions of the test, but the reddish-violet color appears to be specific for copper.—S. G. Clarke and B. Jones (*The Analyst*).

Concerning the Antipyretic Properties of Benzyl Benzoate—The pharmacology and therapeutic properties of this drug were first described by Macht in 1918. He also showed that it is very little toxic for the heart and respiration, that it is readily metabolized by the body of higher animals including man even when given by stomach, and that it is excreted mostly as hippuric acid.

Benzyl benzoate was found to have no effect on rabbits with normal temperature but only in those in which fever had been produced in various ways. It was found that the drug produced a distinct lowering of the temperature in almost all of the cases in which the temperature was abnormally high. The most striking results were noted in the animals in which the fever was due to an infection either by hay infusion or some obscure infectious agent; also after injection of peptone.

As benzyl benzoate is known to be a powerful vasodilator, the fall in temperature produced by it is probably due almost entirely to

its vasodilator effect producing an increased dissipation of heat through the vasodilation of the peripheral blood vessels.

It is interesting to know that benzyl benzoate is excreted to some extent in the bronchial secretions and in this manner acts as an expectorant. This is a factor which makes it of value in the treatment of respiratory infections besides asthma and whooping cough. The findings of this more recent investigation of the drug show that it would tend to reduce the fever occurring in such conditions. It was also shown that benzyl benzoate has practically no narcotic action even when administered in quite large doses.—David I. Macht and Harriet P. Leach, *Journal of Pharmacology and Experimental Therapeutics*, March, 1929, page 281.

J. K. T.

Stimulation of the Growth of Hair—Elsa Eicholz has investigated the action of various agents in stimulating the growth of hair in rabbits, mice, and guinea-pigs, patches of skin being previously shaved and depilated by calcium sulphide and zinc oxide. It was found that chrysarobin and sunlight rays caused hyperæmia and gave the best and quickest growth of hair. Gentle rubbing of the skin with vaseline, benzine, and benzol, and even gentle finger massage, caused slight revival of hair growth, but if the rubbing was severe, so as to produce hyperæmia, the results were almost equal to those obtained with chrysarobin and sunlight. Cholesterin-vaseline and trilysin (an alcoholic solution of cholesterin) gave the same results as simple vaseline; trilysin did not appear to possess any specific property as a hair restorer.—(*Dermat. Woch.*, February 2, 1929, p. 161, through *B. M. J.*, 3559, *54*, 1929, *through Pharm. Jour.*)

"Worm Expellers" Must Be Labeled Correctly—"No drug or mixture of drugs known at the present time can be truthfully offered to the public as an expeller or vermifuge for all types of worms which infest poultry and other animals," according to an official regulatory announcement recently issued by the Food, Drug and Insecticide Administration, of the United States Department of Agriculture.

"The unqualified use of the terms 'worm expeller' and 'vermifuge' in the labeling of these drugs constitutes a misbranding under the Federal Food and Drugs Act unless the name of the specific worm or worms is used for which the preparation is known to be effective.

"Manufacturers of livestock remedies will be held strictly accountable under the Federal Food and Drugs Act for any claims made for expelling any particular type of worm," the administration officials say. "Many of the drugs reported in the dispensatories and other literature as having worm expelling properties have not been found to be effective treatments, according to critical tests conducted by the Bureau of Animal Industry of the Department of Agriculture. Maufacturers of such preparations should acquaint themselves with the latest developments of veterinary science in this respect before making efficacy claims without critical tests by competent scientists being made to prove these claims.

"In addition to the specific name, in prominent type, of the worm or worms for which the preparations are to be used, correct labeling must include proper dosage, if dosage is stated, based on type and weight, size and age of the animal for which it is recommended as a worm expeller," the officials point out.

Labeling of mineral mixtures, stock powders, conditioners and tonics for livestock, when represented to the public by manufacturers as controlling worm infestation, constitutes gross misbranding under the Federal Food and Drugs Act, the officials say. Mixtures of this character administered in the feed are not considered effective treatments for expelling any type of worm infesting poultry and other animals.

In its efforts to have all livestock remedies bear correct labeling, the Food, Drug and Insecticide Administration recently took action against a worthless worm expeller which the makers said was a "remedy for either mild or severe worm infestation of poultry, including tape, round or pin worms." This evasively labeled remedy was found to contain 95 per cent. water, a small quantity of gum and cod liver oil.

Numerous misbranded hog-cholera remedies were removed from the livestock drug market in recent years. Their makers said these preparations would not only cure hog cholera, for which there is no known drug cure, but would also be "effective to destroy lung and intestinal worms."

A "disease preventive worm destroyer" in the nature of a salt tonic was found to contain 90 per cent. of common salt, as well as small amounts of sulphur, sodium sulphate, sodium carbonate, iron oxide and calcium carbonate. This salt tonic was declared grossly misbranded since it was neither a worm expeller nor a disease preventer.

RHEUMATISM "CURES" UNDER FEDERAL EXAMINATION—Although legal action has been taken against as many as 245 so-called "rheumatism cures" by the Food, Drug and Insecticide Administration and the former Bureau of Chemistry of the United States Department of Agriculture, many useless, fraudulent, and misrepresented preparations are still being sold to "cure rheumatism."

Since the Federal Food and Drugs Act was made effective in 1907, 600 notices of judgment have been issued against these 245 "cures" as the result of legal action taken to rid interstate drug trade of these quack products. Both in number of preparations and in number of notices of judgment, the "rheumatism cures" lead the list of drug preparations proceeded against by the Federal authorities.

Public misunderstanding of the word "rheumatism" is largely responsible for the great sale of these "cures," food and drug officials say. "Rheumatism" is common ly believed to be any pain in and around the bones, joints and muscles of the body, regardless of its real cause. For such a loose grouping of ailments no drug or combination of drugs known can be a competent treatment, the officials say.

Such pains and aches as are included by the public under "rheumatism" are known to the medical profession as separate ailments dependent upon different causative factors and needing specific treatment, according to the administration's drug officials. Many cases of "rheumatism," they say, are due to such local infections as of gonorrheal, syphilitic or tuberculous origin, or to infections in some distant part of the body as of diseased tonsils, sore throat, sinus infection and infected teeth, which oftentimes cause neuralgia, neuritis and sciatica, mistaken by the public for "rheumatism."

Then, too, the officials say, urate deposits in the joints cause what is known as gout. There is also a common joint condition called arthritis deforms, in which deformity of the joint is present. Both of these ailments are commonly classified under the word "rheumatism." Certain other cases of "rheumatism" may be due to faulty healing of bone fractures, while still other cases, in which the pain is in the calf and thigh, may be due to fallen arches. Another phase of "rheumatism" in which the attacks are due to rheumatic fever frequently affects the heart in a serious manner and gives pain in various joints of the body.

It is obvious, say officials of the Food, Drug and Insecticide Administration, that no one preparation or treatment can remedy all of

these aches and pains. "Rheumatism cures" are oftentimes made of ineffective plant extractives, red pepper, turpentine and useless mineral salts. These preparations not only fail to give the promised benefits but produce harm by preventing the institution of proper medical treatment.

One purpose of the food and drugs act is to protect the American public by the removal from interstate drug trade of so-called "cures." The work of removing all false, fraudulent, misrepresented and useless "rheumatism cures" from legitimate drug trade will be continued, say the officials.

"Rule of Three" Guards Against Poison Ivy—"Leaflets three, let it be," is good advice for avoiding the misery caused by poison ivy. It may lead to avoidance of some innocent plants, but it expresses a simple rule of safety and bears the indorsement of botanists in the United States Department of Agriculture. In autumn, poison ivy may be recognized by its white, bony, berry-like fruits, in connection with its three leaflets.

Botanists know several kinds of poison-ivy plants and a wide variety of local names such as poison oak, three-leaved ivy, poison creeper, oakleaf poison ivy, climbing sumac, markweed, picry, and mercury. The poison oak of the Western States is also called poison ivy. These plants, and their close relative, poison sumac, are similar in their poisonous properties. "Their poisonous principle," says Farmers' Bulletin 1166-F, "is a nonvolatile oily substance known as toxicodendrol which has such violently irritant properties that the slightest trace deposited on the skin is capable of producing severe inflammation. All parts of the plant contain the poison, even after long drying, but growth in which the sap is abundant is the most dangerous."

All these toxicodendrol-bearing plants, with the exception of poison sumac, are three-leaved, and all have white fruits. The red-berried sumacs are harmless. The Farmers' Bulletin gives a more detailed description of the several kinds of poison-ivy plants. The Department of Agriculture has available a new supply of these bulletins for free distribution to those who apply for them, and it recommends that the bulletin be preserved as an aid in identifying the plants, for advice as to treatment in cases of poisoning, and for the directions regarding eradication of the plants.

Poison ivy grows both as a vine and as a trailing shrub, and it is found on both high and low ground. There is a variety in the South and the Southwest, the oakleaf poison ivy, with leaves having three leaflets which resemble oak leaves. Poison-ivy vines are sometimes confused with Virginia creeper. The "three-leaf" test distinguishes them, for the Virginia creeper is five-leaved. Moreover, it has blue berries, while those of poison ivy are white.

Poisoning usually results from touching or brushing against poison-ivy plants, or from handling clothing or other articles that have been in contact with them. Smoke from plants that are burned may cause serious injury. Some persons believe they are poisoned when passing the plants without direct contact. "The symptoms of poison ivy," says the bulletin, "are produced as the irritant poison penetrates the outer surface of the skin, and they may appear within a few hours or be delayed until five days or longer after exposure.

"After exposure to poison ivy, measures to insure the removal of the poison are of primary importance. It should be remembered that at first the poison is on the surface of the skin and can be removed by thorough washing and rinsing repeated several times. Careless washing, however, may serve to spread the poison. Ordinary kitchen or laundry soap which has an excess of alkali is best for the purpose, and hot water should be used. The soap should be applied freely, so as to produce an abundant heavy lather on the exposed surfaces, and then rinsed off completely. The operation should be repeated not less than three or four times. Running water is preferable, or if a basin is used, the water should be changed frequently. The hands, especially, the finger nails, should receive particular attention."

For prevention, the bulletin recommends solutions of iron salts applied freely to exposed parts of the body and allowed to dry before going into areas infested with poison ivy, or applied immediately after exposure. A solution of five parts of ferric chloride in 95 parts of a half-and-half mixture of water and glycerin, or a solution of one part of ferrous sulphate in five parts of water, is recommended.

Even when the poison has started to work, careful washing with alkaline soap is helpful. In severe cases it is necessary to call a physician. The irritation and annoyance usually increases for the first few days, and then subsides. Victims often try several remedies and may give unearned credit to the one they happen to apply when the poison has run its course.

A 5 per cent. solution of potassium permanganate applied locally is a good remedy. The stain will gradually wash off, but its removal may be hastened with lemon juice. Local applications of solutions of cooking soda or Epsom salt, one or two teaspoons to a cup of water, are ordinarily as helpful as any. Fluid extract of grindelia, diluted with four to eight parts of water is often used. These solutions may be applied with light bandages or clean cloths which should be kept moist and changed often to avoid infection. During the night, or when moist applications cannot be used, the poisoned surfaces should be carefully cleaned and dried and left exposed to the air. Do not bandage them tight. Immersing the poisoned parts for several minutes in water as hot as can be borne increases the discomfort for the moment, but a period of great relief follows.

In the early stages do not use oily ointments. The oils tend to dissolve and spread the poison. After the poison has exhausted itself a mild dressing, such as zinc-oxide ointment hastens healing.

Treatment for sumac poisoning is similar. The plant is much different and is the exception to the "three-leaved rule." It is a shrub, and often grows in clumps, and only in swamps or wet ground. Sumacs on high and dry ground are harmless.

Farmers' Bulletin 1166-F, which also includes directions for eradicating poison ivy and poison sumac, has just been issued in a revised edition, and may be obtained free by applying to the United States Department of Agriculture, Washington, D. C.

NEWS ITEMS AND PERSONAL NOTES

PEREGRINATIONS OF PROFESSORS—Even busy professors have their resting seasons—and their rest, oddly enough, is generally occupied with being on the go.

For instance, Professor LaWall and his wife, Millicent R. LaWall, are touring Great Britain, and enjoying the experience immensely.

Professor Stroup is wandering over the Pacific slopes visiting former pupils, attending conventions and collecting rare chemicals and rarer experiences.

Dr. Sturmer is summering at Lake James, Indiana, one of the few places left where a fish may be caught without the aid of a fisherman.

WOMEN'S COLLEGE CLUB ENTERTAINED—On Thursday, June 27th, over fifty members of the Women's College Club motored to Reigelsville-on-the-Delaware, where they were entertained, throughout the day, at the summer home of Dr. and Mrs. W. W. McNeary.

For the erudite and science-inclined there was a most enjoyable botanical excursion—the rich flora of the Delaware Valley offering a variable collection.

Croquet and golf kept others content and busy.

The croquet tournament, after a strenuous competition, was won by Mrs. Wilmer Krusen—and Charles E. Wetzel, disdaining a handicap, captured the golf honors, with a homœopath's score.

Mrs. Ivor Griffith took the ladies' golf prize, she being the only lady entered in the tournament.

In all—and for all—the day was a glorious one, and the club is indebted to the McNearys for a fine and wholesome treat.

BOOK REVIEWS

TRAVAUX DES LABORATOIRES DE MATIÈRS, MÉDICALE ET DE PHARMACIE GALÉNIQUE DE LA FACULTÉ DE PHARMACIE DE PARIS. Published under the direction of Professors Em. Perrot and Alb. Goris. Vigot Freres, Paris, 1929.

Owing to the fact that this volume consists of nine essays each separately paged, it is not possible without some arithmetic to give an exact statement of total pages but this amounts to several hundred. The publication is well and very favorably known in the department of pharmaceutic research. It covers a wide field. Among the papers is one of unusual type—a study by means of X-rays—of extent to which the materials generally used for encapsuling nauseous drugs or protecting drugs from being set free in the stomach, fulfill this purpose. The research is illustrated with drawings and several large copies of X-ray plates, some showing the encapsuling material quite unbroken. The contribution is the thesis of the author (Charles Jouve) for the degree of doctor of pharmacy at the University of Paris. It covers over seventy pages, and is a careful and comprehensive investigation. The author's general conclusion is that the materials now available seem not well adapted to medication intended specially for the gastro-intestinal tract.

The separate paging of each essay is obviously for convenience in furnishing reprints. Each paper is provided with a colored cover but is not backed. The use of the separate paging makes indexing specially difficult, but French authors and publishers take as a rule, minor interest in indexing, as all know who use their books. The ninth essay consists of four parts, to which four workers contribute but except in one case there is joint authorship of two. The subject of this essay is the pharmacology of digitalis. Perrot is one of the authors. An essay by a pharmacist of the University of Bucharest is an extended study of certain species of *Hyoscyamus,* under the title of "Jusquiames," which traces the use of these plants as sources of powerful drugs back to a remote period.

Many illustrations are in the volume, which is well printed and contains a large amount of valuable information in pharmacology and pharmacognosy.

HENRY LEFFMANN.

LEHRBUCH DER PHYSIOPHARMAKOGNOSIE FÜR PHARMAZEUTEN. By Richard Wasicky, M. D., Ph. M., University of Vienna. 1st part. 8vo., viii-331 pages, 98 illustrations in text and a colored plate. Published by the Carl Fromme Ges. m.b.H. Vienna and Leipzig. 1929.

The reviewer stops on the threshold to commend the make-up of this book. Printed on good paper with just enough surfacing to give good impression of the photogravures and in clear Roman type with an excellent face, it is a pleasure to scan its pages. The author in his intrductory section discusses the relative scope and purposes of pharmacognosy and pharmacology with a view of explaining the exact meaning of his own title, which is probably his coinage. It refers to medicaments that are as he states "closer to nature," presumably the naturally occurring substances in the main, as distinguished from the synthetics. The latter group, which he places under pharmaceutical chemistry, covers, as all doctors and pharmacists know to distress and confusion, a vast mass of new substances mostly due to the patience, skill and interest of German chemists. In the matter of modern synthetics it may be truly said that "many are called but few are chosen," at least, not for long.

A very large amount of valuable information is included in the book set forth clearly and in detail. The theoretical and practical points are comprehensively presented. Structural formulas are used

liberally. Illustrations of important portions of plants add much to the instructive value of the work. One note of slight animadversion is suggested. The representation of the tea-leaf on page 88, shows a distinct projection on the distal end, but most tea-leaves have a slight indentation at that point. It is also somewhat puzzling to note that some of the illustrations are marked "negativbild" though the picture is really a positive. These points are of very little importance, and do not detract in any way from the practical value of a most excellent book. The text includes, as would be expected from the title, the effects of the many drugs considered as well as their physical properties, and full details as to the macroscopic and microscopic structures. The classification of the individual drugs in accordance to their dominant physiologic action. A brief summary of the history of pharmacognosy is included in the introductory matter. From this we learn that the word was first used by Seydler in 1815. Though the word is comparatively recent, the practice of selecting and distinguishing drugs for therapeutic purposes began obviously in a remote period.

The volume in hand, as noted above, is only a part of the series. When completed the work will be a thorough and comprehesive collection of all useful data in pharmacognosy and pharmacology, together with extensive information concerning the therapeutic uses of the drugs included.

HENRY LEFFMANN.

DIE REAGENZIEN UND REAKTIONEN DES DEUTSCHEN ARZNEIBUCHES. By Dr. Herbert Harms. 8vo., 236 pages. Publication Office of the German Society of Apothecaries, Berlin, 1928.

This is a comprehensive and detailed commentary on the reagents recommended for testing the official preparations of the current (6th) edition of the German Pharmacopeia. The descriptive text covers more than two hundred pages, followed by an extensive bibliography and name and subject indexes. Control of medicines has become an extensive and complex problem in the last half-century. The older pharmacopeias contained little more than general descriptions of drugs with a few analytical checks. The first U. S. P. contrasts markedly with the current revision. The former, by the way, was bilingual, Latin and English on alternate pages. Its monkish Latin reminds one of the time when that language was the usual

means of oral and written communication between scientists of several European countries.

In the text of this work a very large amount of important information is given concerning the nature of the reagents, equations of reactions in the operation of the tests, including many structural formulas, and the general nature of the change. It is gratifying to note that in the cyclic formulas the symmetric hexagon is used, and not the vertically elongated form commo in British and American textbooks. The form shown in the original paper suggesting the cyclic structure of benzene was a regular hexagon.

The type used in the book is quite small and has a somewhat full face. Apparently a heavy impression has been used in printing, so that the book is not easily read by those who have passed into the spectacle age. For those who read German fairly easily the book will be very useful. Its preparation has involved much labor and extensive practical and theoretical information.

HENRY LEFFMANN.

COLLEGE CHEMISTRY. By Neil E. Gordon, Professor of Chemical Education, Johns Hopkins University, formerly Professor of Chemistry, University of Maryland. 508 pages of text, 9 pages of double-column Index, 88 Illustrations, 179 Experiments. 1928. Cloth. List price, $2.96. World Book Company, Yonkers, New York.

"This new College Chemistry is for students who have had a course in a secondary school," and omits or barely mentions elements and principles which are strongly emphasized in a beginners' course, and elaborates on those things which cannot be more than touched upon in such a course. The text is subdivided into two main sections, Part One considering the Non-Metals, and Part Two, the Metals. These "Parts" are subdivided into "Units," and the units, in turn, into "Sections." The "Units" of Part One are:

One: Some Fundamentals of Chemistry; Two: Acids, Bases and Salts; Three: Classification of the Eelements; Four: The Halogen Family; Five: the Carbon Family; Six: The Nitrogen Family; Seven: Colloidal Chemistry. The "Units" of Part Two are:

One: The Metallic Elements; Two: The Alkali Metals; Three: The Metals of the Alkaline Earth Group; Four: The Ammonium Sulfide Group; Five: The Hydrogen Sulphide Group; Six: The Hydrochloric Acid Group; Seven: Procedures and Tests in Qualitative Analysis; Eight: Other Periodic Families.

"The experiments and text are built into one." "Numerous questions and equations to be completed are inserted where they immediately apply, in order to stimulate and guide the student in his thiking." Much is left for the student to find out for himself, a very good feature; but the attempt to make a book of its size cover so much ground has resulted in a brevity of statement in not a few instances that is apt to lead the reader astray. For instance, on page 145 appears the statement "When hydrogen and chlorine are mixed, they unite with explosive violence," without any explanation as to the conditions necessary for their union, leaving the student to think that these two gases cannot be mixed and the mixture kept as such, even for a minute. Again, on page 206, in speaking of the combination, under the influence of high temperatures, of basic oxides (like calcium oxide) with silicon dioxide, the statement is made "This action is made use of i the extraction of iron and other metals," leaving the student (not on his guard) to believe that iron is separated from its oxides with silicon dioxide. In several places in speaking of the dissolving of chlorine and bromine, respectively, in water the wording is such as to lead the student to believe that only the haloid acid and the hypohalite acid are formed, and that no free chlorine (or free bromine) remains in the solution.

On page 319 it is said that "Barium, unlike strontium and calcium, forms two oxides," giving the impression that only one oxide each of strontium and calcium are kown. Apparently the author is unfamiliar with a certain commercial tooth powder. On page 375 it is said that magnetic oxide of iron is a "*mixture* (italics ours) of ferrous and ferric oxides," while its properties are not at all those that could be expected of a mixture. *Compound* would have been the better word.

On page 295 it is stated that sodium thiosulfate is "called 'antichlor' because a solution of it in water readily dissolves chloride and iodide of silver" etc.

There are a considerable number of other statements in the book the accuracy of which is open to question. The teacher who uses it will "catch" them and call the attention of his students to them, and thus the damage will be slight, applying chiefly to those who will want to use the book as a reference book.

The general make-up and intention of the volume are commendable, and it should find wide circulation.

F. P. Stroup.

INDUSTRIAL CARBON. An Industrial Chemical Monograph. By C. L. Mantell, Ph. D., Pratt Institute, Brooklyn. 391 pages of text, 3½ pages (tabulated) of Physical and Chemical Problems of Carbon with references to authorities, 1½ pages of References, 9 pages double-column Subject Idex, 3½ pages double-column Author Index, 89 Illustrations. 1928. Net Price, $4.50. D. Van Nostrand Company, Inc., 8 Warren Street, New York.

This book attempts "to cover the technologic applications of elemental carbon, aside from its use as a fuel." "The term 'elemental carbon' is applied to mean those substances, materials and products which are either carbon in its elemental form, or which consist entirely of carbon, or whose value in industry is due to the physical and chemical properties of the elemental carbon from which they are made or which they contain."

The author acknowledges the receipt "of much valuable aid from many actively engaged in phases of the carbon industries," naming specifically nineteen persons who aided him in one way or another. After an introductory chapter there are taken up in order: Diamonds, Natural Graphite, Artificial Graphite, Carbon Black, Lampblack Manufacture, Carbonaceous Ink Pigments, Black Paint Pigments, Charcoal, Bone Black, Pharmaceutical Charcoal, Electrodes, Carbon Brushes, Arc Light Carbons, Carbon Specialties, Battery and Welding Carbons, Pencils, Resistor Carbon and Carbon Refractories, Carburizers.

The text is written in lucid style, which makes for easy and effective reading, not only for those persons interested in industries utilizing carbon but also for the general reader. The book is worthy of a large circulation.

F. P. STROUP.

INORGANIC CHEMISTRY FOR COLLEGES, a Textbook for Students of Second Year Chemistry. By William Foster, Ph. D., Professor of Chemistry in Princeton University. 794 pages of Text, 7 pages of Appendix, 3¼ pages of Bibliograph, 11 pages of Problems, 17 pages of double-column Index, 212 Illustrations. 1929. Cloth. Net price, $3.90. D. Van Nostrand Company, Inc., 8 Warren St., New York.

After an 8-page Historical Introduction the author launches into a discussion of the fundamental principles governing chemical action and an explanation of the so-called "laws" of chemistry as inter-

preted in the light of modern discoveries. The newer theories of atomic structure are thoroughly explained. Fifteen pages are devoted to Radio-active Elements and twenty-seven pages to the Classification of the Elements.

The text is subdivided into three parts. Part I covers the Non-Metals, Part II covers the Metals, and Part III (the shortest of the three) gives a taste (just enough to whet the appetite for more) of Organic Chemistry.

In the discussion of the different elements a fairly uniform procedure is followed, with modifications to suit the particular element, as follows: History, Occurrence, Preparation, Industrial Preparation, Physical Properties, Chemical Properties, Uses.

General principles, both physical and chemical, are discussed and elaborated where they seem to fit in best, viz.:

Catalysis under Oxygen; Valence under Hydrogen; Solution under Water; Molecular and Atomic Weights, Energy and Chemical Change, Ionization, Acids, Bases and Salts, Oxidation and Reduction, after the discussion of Hydrogen, Oxygen and Water.

After each chapter is to be found a series of "Exercises," consisting in part of questions on the subject-matter of the chapter, and in part of mathematical problems. Many of the questions require careful thought on the part of the student, and an ability to form conclusions from data.

All in all, the book contains a wealth of information, attractively written, for not only the college student but the graduate of an earlier day who needs to get better acquainted than he probably is with modern chemical theories.

F. P. Stroup.